The AMSAT® Journal

Editor
Russ Tillman, K5NRK

Editorial Staff
Ron Long, W8GUS
Buzz Gorsky, WH6I
Andy Reynolds, WD9IYT

Volume 21, No. 3 May/June 1998

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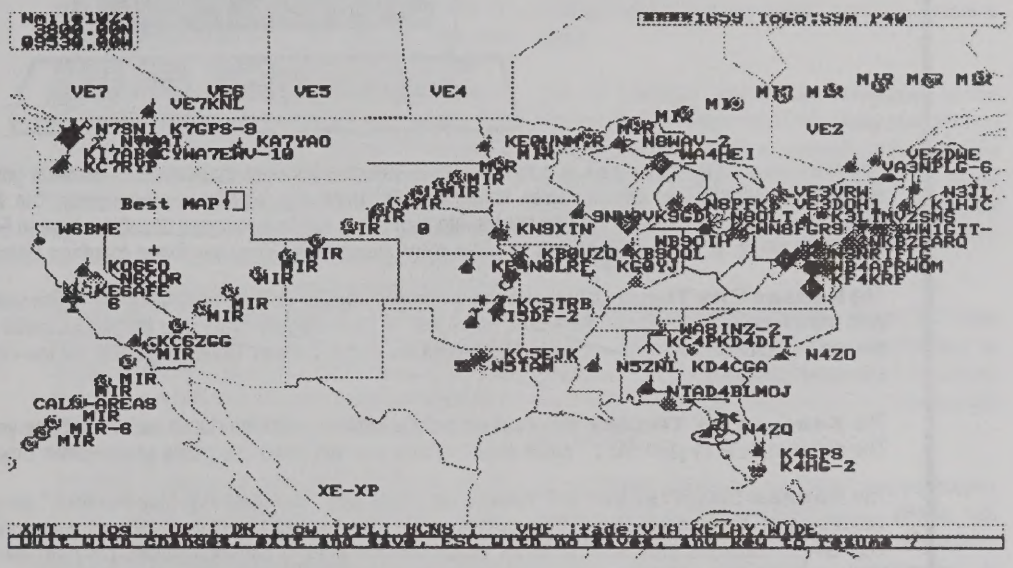

Figure 1. This map shows the APRS display after the third pass. Of the 104 stations participating, 98 percent of those running 10 watts or more were successful. *Mir* appears on the map, because three APRS groundstations were digipeating pseudo *Mir* position packets via *Mir* in real time.

An APRS/*Mir* Test

Bob Bruninga, WB4APR *(wb4apr@amsat.org)*

On 11 March 1998 a special APRS/*Mir* test was conducted via the packet system on the *Mir* Space Station. The test was to show possible methods for improving the visibility of MIREX communications to students and schools. The objectives of the test were to demonstrate the use of:

- One-to-all protocol using UI frames for more effective use of the MIR downlink to multiple participating ground stations.
- Spacecraft beaconing their GPS position a few times per footprint to identify their position.
- APRS map displays to show the moving position of the spacecraft and the locations of all participating ground stations.

[continued on page 4]

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Radio Amateur Satellite Corporation (AMSAT-NA)
850 Sligo Ave., Silver Spring, MD 20910-4703
Telephone: 301-589-6062 Facsimile: 301-608-3410
AMSAT-NA Club Call Sign - W3ZM
AMSAT WWW: http://www.amsat.org

***The AMSAT Journal* Staff:**
Editor in Chief: Russell K. Tillman, K5NRK
Circulation: Martha Saragovitz
(*martha@amsat.org*)

Editorial Staff:
Ron Long, W8GUS
Buzz Gorsky, WH6I
Andrew Reynolds, WD9IYT

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Editorial Office: Russ Tillman, K5NRK, 113 Rollingwood Drive, Vicksburg, MS 3910-9510, Internet: k5nrk@amsat.org, telephone and fax: 601-634-6398.

Advertising Office: AMSAT-NA Headquarters, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703.

The AMSAT Journal (ISSN: 1407-3076) is published bi-monthly (Jan, Mar, May, Jul, Sep, Nov) by AMSAT-NA, 850 Sligo Avenue, Silver Spring, MD 20910-4703. Telephone: 301-589-6062, fax: 301-608-3410. Periodicals postage paid at Silver Spring, MD, and additional mailing offices. Postmaster, send address changes to *The AMSAT Journal*, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703.

The AMSAT Journal staff is always interested in article submissions. Whenever possible, text should be on IBM compatible diskette with hard copy or original photographs or figures. AMSAT-NA reserves the right to select material for *The AMSAT Journal* based on suitability of content and space considerations. The editors of this publication are volunteers giving freely of their talents, time, and efforts to produce *The AMSAT Journal*.

Apogee View

Where Are We Going, and What Are We Doing?

Bill Tynan, W3XO

The debate rages on. Various vocal individuals continue to beat the drums for more *Mode A* birds. Others contend that what is needed are more FM satellites like AMRAD OSCAR -27. Still others decry the fact that the digital satellites we have won't last forever and that replacements must be under construction now. Of course, everyone moms the loss of AMSAT OSCAR-13 and the fact that AMSAT OSCAR-10 is a sometimes thing. Note, I have used the complete names to remind everyone that the "A" in AO-27 stands for AMRAD, not AMSAT. This illustrates the point I want to make. The popular AO-27 was not built by AMSAT. Nevertheless, it owes its existence to AMSAT. The Amateur Radio package, that allows us to enjoy those coast to coast FM QSOs, is mounted in an experimental satellite called EYESAT, which was built by a company called Interferometrics. The amateur portion was built by hams at AMRAD, a research and development minded radio club in the Virginia suburbs of Washington, DC. EYESAT is a Microsat, almost identical in design to the four Microsats which AMSAT-NA and associates built back in 1989. These four Microsats, AO-16, DO-17, WO-18 and LU-19 were all launched on an Ariane vehicle in January 1990. IO-26, which was launched along with AO-27 in September 1993, is also a Microsat, again based on the original AMSAT design. The point I am trying to make is that it was the Microsat design which was picked up by a commercial company and used to build an experimental satellite which houses an amateur package that is what we know as AO- 27, one of the most popular amateur satellites operating today. In case you're wondering, Interferometrics built EYESAT with the full knowledge and cooperation of AMSAT-NA; with AMSAT-NA being compensated for use of the design. This compensation went most of the way toward paying off the expenses AMSAT incurred developing and constructing the four Microsats.

So, not only did we directly design and construct four spacecraft which became popular and useful amateur satellites, but that activity led to two additional amateur communications facilities, IO-26 and AO-27. As noted, AMSAT-NA was not alone in the building of the original four Microsats. People from Weber State University in Utah participated and did much of the work on WO-18. AMSAT Argentina was also represented, which led to LU-19. The Brazilian, BRAMSAT, involvement culminated in DOVE (DO-17). So, a cooperative effort was involved, one which, it is important to point out, included the academia community.

The message I have is that many of the activities in which AMSAT engages, frequently leads to amateur spacecraft even if they are not directly produced by AMSAT-NA, or any overseas AMSAT group. So, although it may not be obvious that we are building such and such a satellite, we continually work, sometimes behind the scenes, with other organizations that may very well produce results that will benefit amateurs worldwide.

As recent examples, several such projects, that AMSAT-NA has been quietly assisting, come to mind.

One is *SEDSAT* which was completed at the Huntsville Campus of the University of Alabama. This spacecraft, which is currently scheduled for launch next October, will carry a 2 to 10 meter (Mode A) transponder as well as digital communications facilities using the 1260 and 435 MHz bands.

Another is *AUSSat*, (see the May/June 1997 issue of *The AMSAT Journal*) being constructed by students at Arizona State University. It is to have both voice and digital capability on 2 meters and 70 cm.

The Citizen Explorer, undergoing preliminary design work at the University of Colorado, will provide a beacon in an amateur band and measure various upper atmosphere phenomena of importance to radio propagation, and thus of great interest to hams.

As noted in a past issue of this Journal, *MOST*, shows good promise of going forward. If it does, AMSAT-NA has promised to lend considerable technical assistance. Not only has an Amateur Radio communications package been promised in return for such assistance, but significant funding as well. This funding will be very helpful in assuring the continued viability of our organization, including its ability to undertake future amateur satellite projects.

We are also providing technical assistance to a project at the University of Central Florida. While not an amateur satellite project, preliminary indications are that cooperation with UCF may well lead to significant benefits for both AMSAT and the University, benefits which also may materially improve our ability to construct future amateur satellites.

Just in the past two weeks, I received a telephone call from a highly placed gentleman in the Whiting School of Engineering at Johns Hopkins University (JHU) in Baltimore, Maryland. He wanted to know if AMSAT wished to participate, with JHU, in responding to a Request for Information from NASA in connection with *Triana*. Triana is the project proposed by U.S. Vice President Gore to place a spacecraft at the L1 point about 1.5 million kilometers from Earth,

between Earth and the Sun. Mr. Gore's concept is for the Triana spacecraft to take continuous pictures of the sunlit Earth and send them down for access by school children and others. AMSAT-NA was asked if we would like to propose an Amateur Radio package to go aboard Triana. I quickly arranged a telephone conference with the AMSAT-NA Board of Directors, which approved us going ahead at least as far as participating in the JHU response to NASA. With the help of a number of technical experts we can call on from time to time, we were able to put together material for inclusion in the Hopkins response. Of course, it's too soon to know if it will lead to anything, but it appeared to be worth pursuing. So, we did.

A project which can mean a lot to Amateur Radio is the *International Space Station* effort. Amateur Radio is now officially manifested on the Station and AMSAT-NA, along with a number of groups in other countries, are laying plans to supply equipment for use aboard it, as well as to help train operators.

In addition to our commitments to Phase 3D, these are but a few examples of things AMSAT-NA is doing to try to promote Amateur Radio space activities. Some may lead to something interesting for us hams. Some may not. But one never knows until some effort is expended to find out.

I should also point out that all of these activities have had to be carried without interfering with our primary activity, our role in the Phase 3D Project.

So, please bear in mind, that, just because you don't see news stories about AMSAT-NA building, or planning to build a new Mode A satellite, another Packsat, or FM repeater in space, a-la AO-27, that we are not doing everything we can to encourage and assist other organizations which are currently undertaking, or considering such projects. And please also remember that, some of the science-oriented projects we might participate in, can help our continued existence and thus future amateur communications satellites.

Needless to say, we will have a lot more to say about these various projects as they come closer to fruition. We will also be soliciting the views of our members, the League and other various amateur groups concerning possible new projects once Phase 3D is safely in orbit. ■

[APRS/*Mir* continued from page 1]

- Linked Internet groundstations to distribute the live downlink collected from ground stations all over the U.S. to users worldwide in real time.

Background

The Automatic Packet/Position Reporting System (APRS) is a connectionless protocol using UI frames to communicate information efficiently among a large group of stations in real time. Each station with information transmits, and all stations capture, sort, and accumulate the information on a variety of display pages or windows as follows:

- BULLETINS: Lists bulletins in sequence regardless of receipt order
- MESSAGES: Displays messages to and from your station
- TRAFFIC: Displays messages between other stations
- STATUS: Displays the current status of all stations
- POSITIONS: Displays the current position of all stations
- TELEMETRY: Displays any telemetry packets
- HEARD LOG: Shows number of packets per station per hour, etc.

Although most people associate APRS with GPS position reporting, a GPS is not required unless a station is moving. Moving stations use a GPS to automatically update their position, instead of requiring manual entry. The primary advantage of APRS is sharing information between the largest possible number of users efficiently over a single shared channel.

Mir Bulletins

The *Mir* packet radio link is ideal for a one-to-all protocol for distributing BULLETINS, ANNOUNCEMENTS and other information to all users in the footprint. Although *Mir* currently transmits a few single-line bulletins, these are sometimes lost among the hundreds of other ACKS, REJECTS, and BUSY packets in the downlink that sometime overshadow any transfer of information. By using a protocol such as APRS to receive the *Mir* downlink, monitoring stations can capture properly formatted BULLETINS and ANNOUNCEMENTS of interest to everyone and display them in a user friendly manner.

Mir Position Tracking

Since APRS has a full mapping capability, it can simultaneously display the location of all ground stations, and plot the moving position of a spacecraft with an onboard GPS. But since a hardware upgrade to add a GPS to *Mir* is not likely, the same effect can be accomplished by a few strategically placed *Mir* tracking stations that transmit up a *pseudo-GPS position* to be digipeated by *Mir* to all ground stations. Three such stations could provide this service whenever *Mir* is over the USA. These stations transmit only a single 1/2 sec packet every minute (1 percent of channel capacity) and the result is an accurately moving *Mir* icon on all ground station maps (Figure 1).

Participating Station Display

Since the *Mir* PBBS is a single user system, it can usually only be accessed by one or two users per footprint under good conditions. Meanwhile, other users send competing CONNECT-REQUEST packets which reduce channel efficiency. The constant stream of DISCONNECT-BUSY packets in the downlink conveys the number of users participating in the pass, but carries no useful information. If instead of useless connect requests, these same stations simply transmitted a single compressed position report it would not only show who is participating in the pass, but also show the distribution of these stations on APRS map displays with no additional loading on the channel. The flavor conveyed to the users in this case is a feeling of camaraderie as a participant with others in a pass instead of individuals fiercely competing with each other for single user access. This in itself is a better attitude to convey to students, and the map display is certainly more visually appealing than a scrolling display of packets.

Internet Interlinked Groundstations

With the worldwide connectivity of the Internet, the downlink packets from *Mir* can be received by groundstations anywhere and made available to all users everywhere. For over a year, the APRServe system has been providing that kind of connectivity to APRS packets generated nationwide. During the APRS/*Mir* test it allowed stations outside of the footprint to observe the event. Similarly schools without Amateur Radio equipment can obtain easy access to data from the *Mir* downlink.

The APRS/*Mir* Test

The test was scheduled at a time when the packet system had been operating well and before North American passes would have occurred outside of school hours. Dr. Dave Larson, N6CO of the MIREX group authorized the APRS/*Mir* test on only two orbits on March 10, 1998. Unfortunately the *Mir* packet system went off the air during these two orbits, so the test was extended to the next few orbits over the USA. But the delay further complicated matters since the next orbits over the USA were between 0230 and 0400 local time (0730-0900 UTC). As a result, the test was extended for a full five orbits to allow participants to choose a pass and still get some sleep. The test was limited to the USA only because it had sufficient numbers of existing APRS groundstations to fully load the system.

With the short notice of the test, and since the more efficient SPACE mode of APRS had not been used or tested since the STS-74 and STS-78 SAREX and SPRE Missions over two years ago, APRS users were told to just operate normally on the *Mir* frequency but to shorten their position comments where possible. The SPACE mode compresses the station's position report into his gridsquare to save 16 bytes per packet. Due to the typical 10 minute duration of a *Mir* pass, participants were told to transmit position reports once every 3 to 4 minutes to get a reasonable probability of success per orbit.

To make Mir appear to move on all groundstation maps, three special tracking-uplink stations beaconed the moving position of *Mir* via the *Mir* digipeater. One from California using the callsign MIR-6, one from Michigan using MIR-8, and one in Maryland using MIR-3 to match their callsign areas. West coast stations would see the moving MIR-6, Midwest stations would see the incoming MIR-6 change to a MIR-8 and then east coast stations would see the moving ICON on their maps change to a MIR-3.

Although *Mir* was not programmed to transmit any special Bulletins, several ground stations transmitted such BULLETIN, STATUS and MESSAGE packets. Over 65 separate packets were successfully captured during the test. On average these packets were transmitted successfully twice (110 times). The advantage of using the few specially authorized uplink sites to digipeat bulletins instead of having *Mir* originate bulletins means that the bulletins may be updated instantly on the ground and then digipeated to ALL users at once without requiring an upload to the BBS nor hundreds of individual downloads. Only bulletins originated from *Mir* would need to be entered by the crew.

Each of the participating stations transmitted their brief position packet once every 3 to 4 minutes. These packets were far less frequent than the usual once-every-10-seconds CONNECT-REQUEST packets which normally congest the uplink. Each time one of these packets was successfully digipeated by *Mir*, all user map displays in the footprint would be updated with colorful Icons showing all stations' locations. During the test 202 station position reports were displayed averaging about 40 per pass.

To inject the downlink from *Mir* into the Internet, a few of the normal APRS I-Gates tuned their radios from the normal APRS frequency to the *Mir* 145.985 MHz downlink frequency. These *Mir* packets were intermingled with the normal stream of APRS packets into the APRServe Internet system. Although they would be seen on the main *http://www.aprs.net* maps they would be hard to distinguish from the usual 1000 to 1200 or more APRS stations on the air. To provide a unique display of the APRS/*Mir* packets alone, a special WEB page was designated to filter out only the APRS/*Mir* packets and display them separately to users. During the day of the event there were over 11,000 hits on the server system representing a peak load of 150 simultaneous users and as many as 1000 users on the special MIREX page.

Statistics

In raw numbers, Table 1 compares the APRS packets during the test to the other packets observed on the downlink. These statistics were mostly derived from observations on the eastern U.S. coast (Maryland) plus the APRS packets logged elsewhere.

Of the 202 APRS stations, 6 were associated with schools and 5 were mobiles including one Naval Academy boat, and one railroad car. Individual APRS packets were also reported by single stations in Taiwan, South Africa, Australia, Japan and Hawaii. Although APRS users were encouraged to only send their position report until the total load on the channel could be assessed, there were still 65 Bulletins and Messages that were successfully relayed. Since the test was conducted over multiple passes, the 202 successful stations actually represent 104 different stations.

Success Rate

Of these 104 different stations, all were running 10 watts or more, but two were successful at 5 and 7 watts. Of the ten stations reporting a lack of success, 3 were running only one watt, and two were running 4 and 9 watts. Two stations were running 10 watts and 50 watts but beacon rate was unreported. One station was only transmitting once an hour, and one was transmitting once every five minutes. Another station was using an indoor antenna. If you consider a 10 watt baseline and proper setup with a 3 to 4 minute rate, then the success rate appears to be near 98 percent. Although there may be many more stations that did not report their lack of success, these numbers clearly show that the channel was not saturated nor congestion limited. In fact, during this test a nominal 3 *Mir* PBBS users logged onto the BBS per pass, but typically only one was successful

Table 1. A Comparison of APRS/*Mir* Packets - March 11, 1998

PASS TIME	TOTAL PKTS	PBBS PKTS	PBBS USERS	BUSY REJ	R0MIR PKTS	R0MIR USERS	APRS PKTS	APRS USERS
0740z	229	88	3	18	30	1	89	44
0910z	153	46	3	7	14	0	102	41
1050z	122	47	3	5	11	0	75	51
1220z	170	96	3	15	35	4	72	39
1400z	188	94	5	12	41	3	53	27

at uploading and downloading any traffic. Actually this is rather typical on most passes during user hours, but in the middle of the night, as in this test, these BBS users would have expected a less congested channel.

Lessons Learned

- Due to the short lead time to the test, there was insufficient time to educate all users to use the short Gridsquare or compressed SPACE mode, and to remove unnecessary verbiage from their position reports. For this reason there were many quite verbose packets. A 30 percent improvement could be expected here.
- Similarly, the SPACE mode was not used. This further reduces bandwidth by automatically canceling all further transmission as soon as one's own packet is successfully digipeated. With the 3 to 4 minute cycle time used and without the automatic cancellation on success, there were probably double the number of packets transmitted than were actually required.
- Non APRS stations were requested to use the very efficient grid square method of reporting position by placing their gridsquare in the UNPROTO TOCALL mode. Unfortunately, this does not work on Kantronics TNC's which always send their BText UI frames to the callsign of BEACON. So their packets conveyed no position information.
- For the pseudo moving MIR-6, MIR-8, and MIR-3 uplinked posits, these should have all used the same ICON name of just *Mir*. Although the numbered *Mir* Icons made it possible to easily see which uplink station was responsible for the ICON, the changing calls meant that as the MIR-6 and MIR-8 uplink stations passed out of range, these positions were stuck on the map at their last uplinked position and stopped moving. By using the same ICON name for *Mir*, then the single ICON would have continued to move as long as there was at least one uplink station in range.
- The uplinked *Mir* positions were more static than dynamic since only about 20 were recorded on all five passes. At one per minute, this shows only a 20 percent success rate for the possible 100 pass minutes. Higher power or tracking antennas may be required.

Conclusions

The test was successful in meeting all of the original objectives. The short notice and early morning hours helped to reduce the number of participants to about 104 stations. We think this number is representative of the nominal number of schools that could be authorized to simultaneously participate in future such *Mir* experiments. A total of 12 stations associated with schools and students were reported. One station even displayed 5 APRS stations while operating with a whip antenna inside a motel room.

The test demonstrated the value of using a UI frame one-to-all packet protocol to improve the delivery of information to all ground stations. Further, the test demonstrated the value of a few special MIREX ground stations to uplink the moving *Mir* position reports and to relay real-time MIREX bulletins and announcements that can be received by all stations in the footprint including receive-only school stations. Finally, the test demonstrated that multiply Internet connected ground stations can provide continuous data from the downlink across the whole country, and permit schools outside of the footprint or without Amateur Radio equipment an opportunity to view data on the World Wide Web. You can see a replay of the event by using APRS to replay the file MIRTEST.HST or by visiting *http://www.aprs.net/mirex.html*.

All of the APRS stations want to thank the MIREX team and also those normal *Mir* BBS users who were inconvenienced by this test, for this opportunity to conduct this important experiment. ■

Satellite Band Designations

Ed Krome, K9EK (ex-KA9LNV) *k9ek@amsat.org*

A quick quiz....What do *S band*, *13 centimeters* and *2400 MHz* all have in common? Those who have been at this a while will grin; but many will scratch their heads. The answer is, simply, that they are all different ways of referring to the same thing; one of our microwave bands.

With Phase 3D on the near horizon, the new satellite operator finds himself bombarded with all manner of cryptic designations, some of which eventually start to make sense and some which just make no sense at all. Satellite operation may seem pretty daunting to a person who finds himself completely baffled by just the band names! This article is an attempt at clarification and simplification, with a little history thrown in for good measure.

Wavelength

When an HF operator refers to *40 meters*, every ham knows that he (or she) is referring to the chunk of RF real estate between 7 and 7.3 MHz. *40 meters* is the approximate wavelength of a 7 MHz signal. This comes from the fact that light (and radio waves in free space) move at approximately 300,000 kilometers/second. A wavelength is defined as the distance between two identical points one full wavelength apart. If we divide 300000 km/sec by 7000000 cycles/sec, we get one wavelength equal to 0.043 km, or 43 meters. Convention (and a bit of literary license) has dictated that we simply call this the *40 meter band*. This equation may be simplified. To work in more familiar units of meters and megahertz,

$$\text{Wavelength (meters)} = \frac{300}{\text{Frequency (MHz)}}$$

As the frequency gets higher, it is usually easier (and conventional) to switch from meters (the number gets too small) to centimeters. At one time, the 70 centimeter band (430 MHz) was referred to as the *¾ meter* band. Higher still, the term millimeters is used, though most ham usage is in the meter and centimeter bands. To work in centimeters,

$$\text{Wavelength (centimeters)} = \frac{30000}{\text{Frequency (MHz)}}.$$

From this, we calculate that *2400 MHz*, has a wavelength of 12.5 centimeters. This band is referred to as the *13 cm band*, probably because the terrestrial guys on 2304 MHz (which really is 13 cm) were there first.

If you like to work in feet,

$$\text{Wavelength (ft)} = \frac{984}{\text{Frequency (MHz)}}$$

although referring to *2 meters* as the *7 foot band* won't make you too many friends.

Expressed in inches,

$$\text{Wavelength (inches)} = \frac{11808}{\text{Frequency (MHz)}}.$$

S-Band

That was all quite logical; now comes the fun part. Where in the world did the designation *S band* come from? This is where logic seems to completely give way to tradition. As I understand it, in the early days of radar, with World War II looming large, research projects had cryptic acronyms to improve security. The RF spectrum was divided up and given letter designations. These designations have changed over the years as band usage changed. I have found several different alphabetic band identification schemes and there are most likely several more. These include *Official JCS band*, *Old JCS band*, *U.S. Microwave band* and various waveguide designations, including the *MDL band* (Microwave Development Laboratories, Inc.), which matches the *Old JCS band*. It appears that we presently use the *Old JCS band* designations, as referenced in Appendix A of *Practical Microwaves* by T.S. Laverghetta.

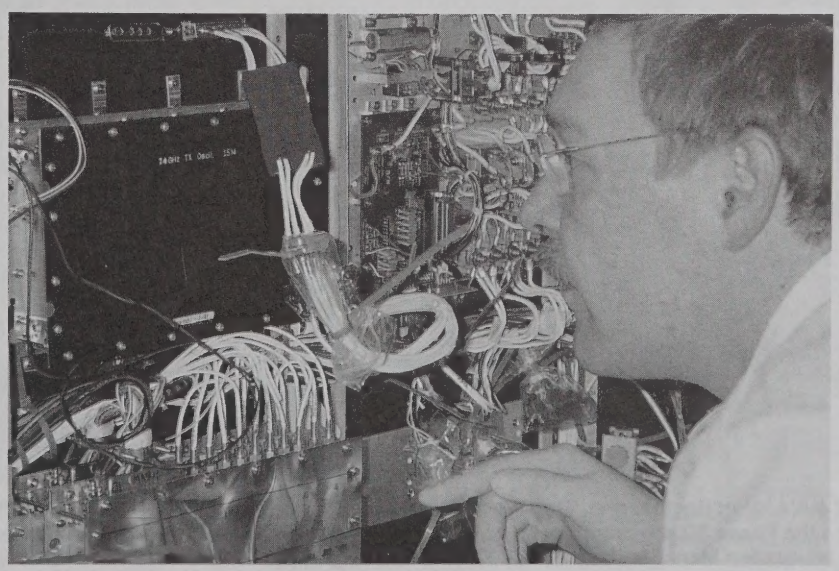
The *Old JCS band* defines the spectrum as follows:

- V (VHF) = 100 - 300 MHz
- U - UHF = 300 - 1000 MHz
- L = 1 - 2 GHz
- S = 2 - 4 GHz
- C = 4 - 8 GHz
- X = 8 - 12.4 GHz
- Ku = 12.4 - 18 GHz
- K = 18 - 26 GHz
- Ka = 26 - 40 GHz
- Millimeter = 40 - 100 GHz

An amateur frequency that falls within a given range is referred to by that range designation. Consequently, 2400 MHz, which we have already defined as the *13 cm* band may be referred to as *S band*. Phase 3D will have uplink frequencies in bands V, U, L, S and C. Downlink frequencies will be in V, U, S, X and K. In those bands where uplink and downlinks are both available (V, U and S), Phase 3D will never transmit and receive in the same band simultaneously.

Uplink/Downlink

Those with satellite experience will remember that, in the past, a satellite's up and downlink band pairing was designated



Stefaan Burger, ON4FG, uses a rubber-gloved hand to carefully inspect adjacent wire clearances between Phase 3D's 24 GHz (K-Band) transmitter oscillator module (upper left) and the IF matrix module (lower left). (AMSAT-NA photo by Keith Baker, KB1SF)

Phase 3D Uplinks

BAND	DIGITAL (MHz)	ANALOG (MHz)	CENTER (MHz)
15M	N/A	21.210 - 21.250	21.230
V (2m)	145.800 - 145.840	145.840 - 145.990	145.915
U(70cm)	435.300 - 435.550	435.550 - 435.800	435.675
L(23cm)(1)	1269.000 - 1269.250	1269.250 - 1269.500	1269.375
L (23cm)(2)	1268.075 - 1268.325	1268.325 - 1268.575	1268.450
S (13cm)(1)	2400.100 - 2400.350	2400.350 - 2400.600	2400.475
S (13cm)(2)	2446.200 - 2446.450	2446.450 - 2446.700	2446.575
C (6cm)	5668.350 - 5668.550	5 668.550 - 5668.800	5668.675

Phase 3D Downlinks

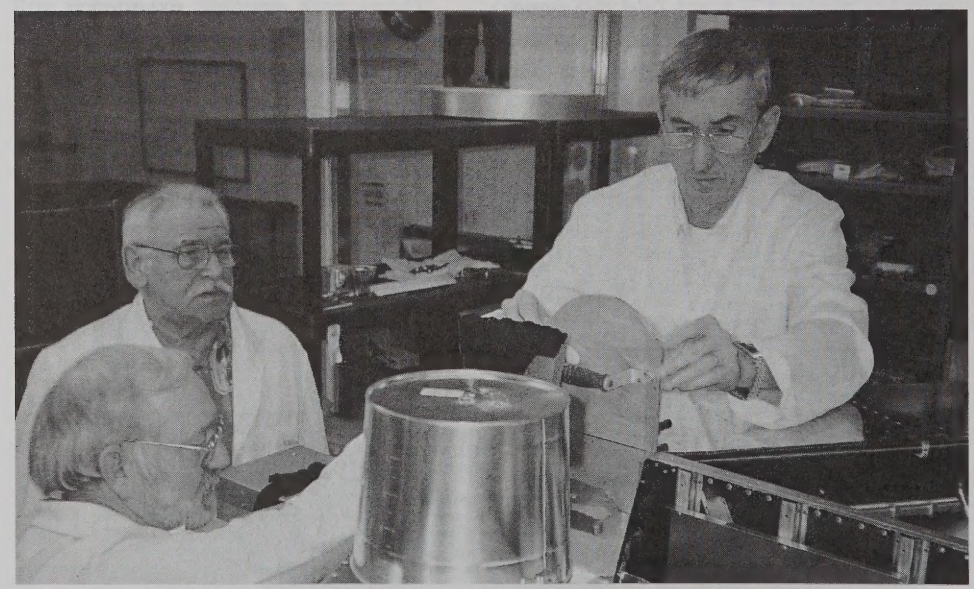
BAND	DIGITAL (MHz)	ANALOG (MHz)	CENTER (MHz)
V (2m)	145.955 - 145.990	145.805 - 145.955	145.880
U (70cm)	435.900 - 436.200	435.475 - 435.725	435.600
S (13cm)	2400.650 - 2400.950	2400.225 - 2400.475	2400.350
X (3cm)	10451.450 -10451.750	10451.025 - 10451.275	10451.150
K (1.5cm)	24048.450 - 24048.750	24048.025 - 24048.275	24048.150

All downlink passbands are inverted from the uplink passbands.

Phase 3D Beacons

BAND	Beacon-1	Beacon-2
V (2m)	N/A	N/A
U (70cm)	435.450	435.850
S (13cm)	2400.200	2400.600
X (3cm)	10451.000	10451.400
K(1.5cm)	24048.000	24048.400

Figure 1. Phase 3D Frequencies. (Originally published in QEX, The ARRL Experimenter's Exchange, February 1995 by Harold E. Price, NK6K.)



AMSAT-NA's VP of Engineering, Stan Wood, WA4NFY, (R) uses a machinist's level to precisely balance the Phase 3D spacecraft in its construction cradle while Lou McFadin, W5DID, Phase 3D Integration Manager (far left) and Konrad Mueller, DG7FDQ, AMSAT-DL's Structural Specialist assist. The *upside down paint bucket* on the top of the spacecraft is a dummy load that covers the opening of one of Phase 3D's 10 GHz horn antennas during testing. (AMSAT-NA photo by Keith Baker, KB1SF)

by a single letter; usually the letter of the highest band in the pair. Uplink receivers and downlink transmitters were typically hardwired in the satellite as a pair, so it was universally accepted that the word *Mode* followed by a single letter always meant the same pair of frequency bands. For example, AO-10 and AO-13 had *Mode L*, which meant L band (1269 MHz) uplink with U band (436 MHz) downlink. Unfortunately, the most common usage pairs were exceptions to this. You just had to memorize the meanings. Mode B is 436 MHz uplink and 146 MHz downlink, while Mode J is the inverse of this. Go figure. But, a single letter always meant the same thing, so the system worked.

Phase 3D has separate receivers and transmitters for each band. All share a common Intermediate Frequency (10.7 MHz) and are connected through a switch matrix. It will be technically possible (though not physically practical for reasons beyond the scope of this article) to use any combination of up and downlink frequencies that are not in the same band. If the designers of Phase 3D had stuck with the *single letter* band pair designation, we have so many possible combinations that we would have alphabet soup! Therefore, it was necessary to develop a method of designating up- and downlink combinations that is both flexible and unambiguous. The new system uses the band designations for each band in the pair, with the uplink listed first, then a forward slash, then the downlink. Therefore, from our example, the band pair that would have been designated on AO-13 as *Mode L* will now be referred to as *L/U*, which unambiguously states: *L band (1269) uplink, U band (436) downlink.* Phase 3D will also be able to couple the L band uplink with V, S, X and K band downlinks, so we will also have modes *L/V, L/S, L/X,* and *L/K.* For our other examples, the old Mode B will be *U/V* and Mode J will be *V/U.* All we have to do is remember the band designations, and the mode pairings are unambiguous. An excellent system.

The actual frequencies to be used on Phase 3D are listed in Figure 1 and also appear on the AMSAT web site, at *http://www.amsat.org* in the Phase 3D section. Good luck and see you on Phase 3D! ■

Phase 3D is Getting Ready to Fly

Gerd Schrick, WB8IFM (*wb8ifm@amsat.org*)

As the reassembly and checkout of the Phase 3D satellite at the Orlando Lab is in full swing, everyone wants to know when it will finally be launched. We all hope that this might be soon, since our *flagship satellite*, AO-13 now has been *off-the-air* for two years.

I have just spent some time at the lab in Orlando and I am quite impressed with this *bird*. Phase 3D is by far the biggest and most complex amateur satellite ever built. In fact, as far as the multitude of transponders, cameras, propulsion, station keeping and other systems and experiments are concerned, it might well be more complex and innovative than any commercial satellite. While commercial satellites might be bigger and have lots of transponders, they are all of the same design and transmit in the same frequency band.

Phase 3D has 39 major electronic modules, not counting preamps, relays, various sensors and couplers. All of these electronic components have been developed and built by hams from various countries, making this satellite a truly international effort, and you cannot but be impressed by all this talent bringing to bear on completion of this satellite. I was fortunate to meet most of these people, look over their shoulders, learn and help with their tests. Work goes on at the assembly lab seven days a week. However, we from *out of town* took Sundays off to relax and gain strength for the upcoming week.

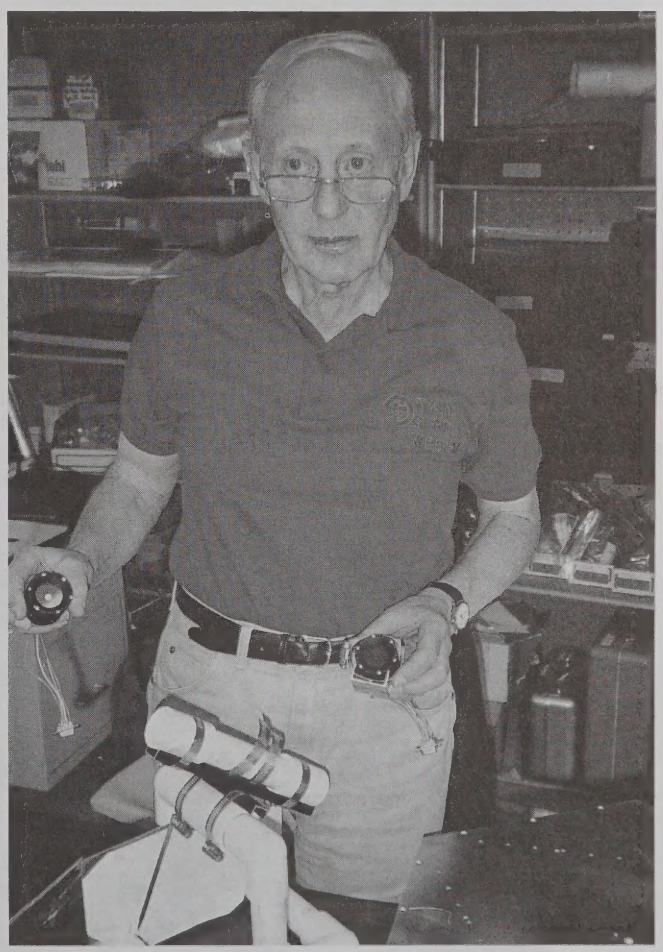
The part of the satellite that we *electronic types* usually do not pay too much attention to is not less impressive. It includes the structural frame, the covers including thermal blankets, two propulsion systems, an ingenious heat distribution and equalization system, and for *just in case* some electrical fuel tank heaters. One aspect of the mechanics is the weight distribution which should lead to a close to perfect balance without adding extra weight. Excess weight has to be paid for with a compromise in the desired orbit and, as it stands, the satellite is already a bit on the heavy side.

I learned a lot about how to put a satellite together. A distinction is made between actual *flight hardware* and test or mockup hardware. Flight hardware is specially treated and stored. All final installation, work and checkout takes place in a *clean room*; before you go in, you clean your shoes, then put on a clean white coat and use gloves; if something is dropped on the floor it stays there to be picked up later and cleaned. For wiring, no mechanical stripper is permitted; all is done with a heat stripper, you never pull a wire to avoid stress and form gentle bends only. Connections are soldered and covered with shrink tubing. Only special sticky tape called *Kapton* is used which is suitable for the cold temperatures and the vacuum of space. I never asked the price of this tape, but I will bet it is not cheap. So are prices for other parts and components. Various *alcohols* are everywhere for cleaning components you work with, and critical parts get covered with Kapton temporarily.

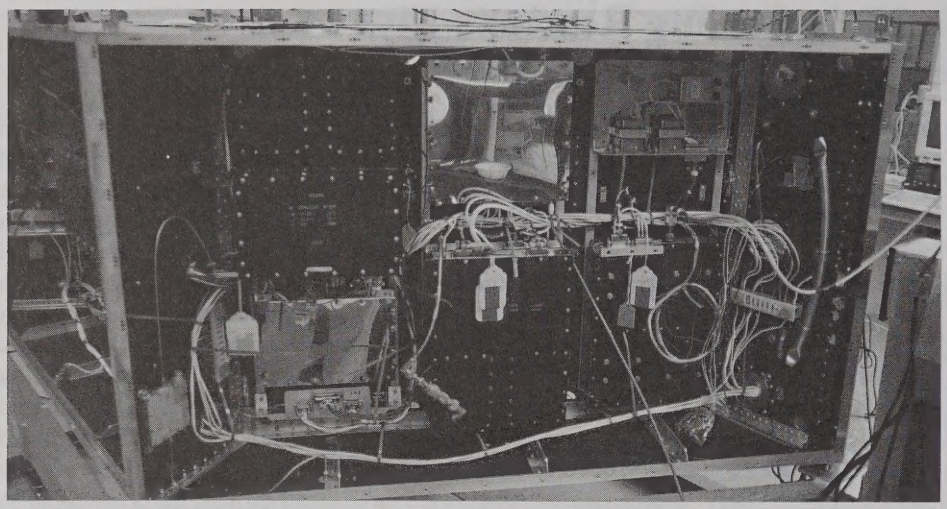
I helped install a series of thermal sensors (thermistors) which were glued with two component epoxy to the critical points that needed to be monitored. By the way, a number of these came from my home state of Ohio. They were donated by YSI, the Yellowsprings Instrument Company, and more were sold to AMSAT at cost. As each installation progresses in steps, the work is carefully labeled with different color tags. For an outsider work seems to go on at a deliberate, but slow pace. This, of course, is done to minimize errors, and believe me, errors do occur. The point is to correct these and make sure that by the time of launch everything is in tip-top shape.

The lab is well-equipped, although most test equipment is somewhat dated which was no problem since I spent my career with this *older equipment*. Furthermore, I could supply the talent for making *semi automatic* measurements, having started as a young engineer in a *measurement lab* of a big manufacturer. The machine shop had all the essentials of a well equipped garage but lacked the precision machinery needed for some components. These parts were either made in Marburg, Germany or by a friendly mechanic in a nearby aircraft repair facility in his spare time. Outside of the lab there are three small offices, a storage room and a large open area for storing large pieces such as the SBS (satellite bearing structure) and satellite mockups for antenna measurements and for doing some crude and/or noisy work and packing.

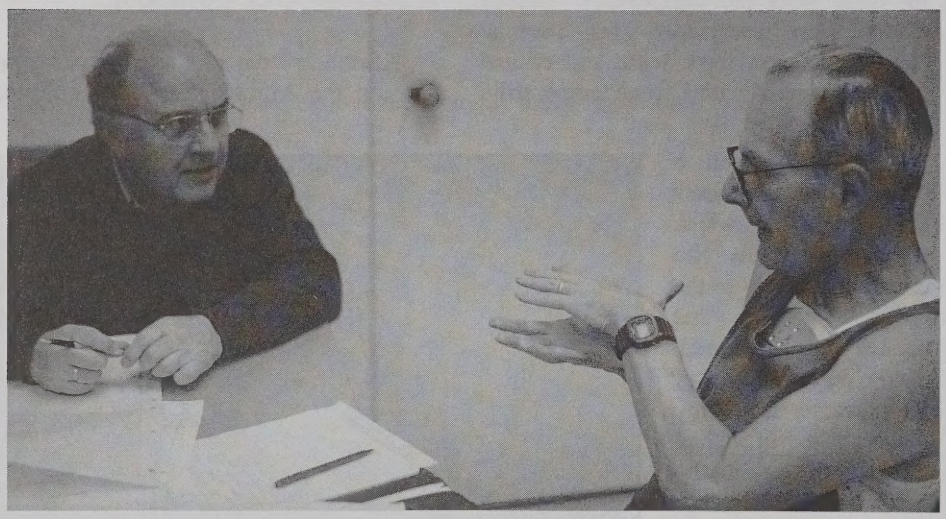
After a few days I started working *full time* on the Attitude Sun Sensor Project



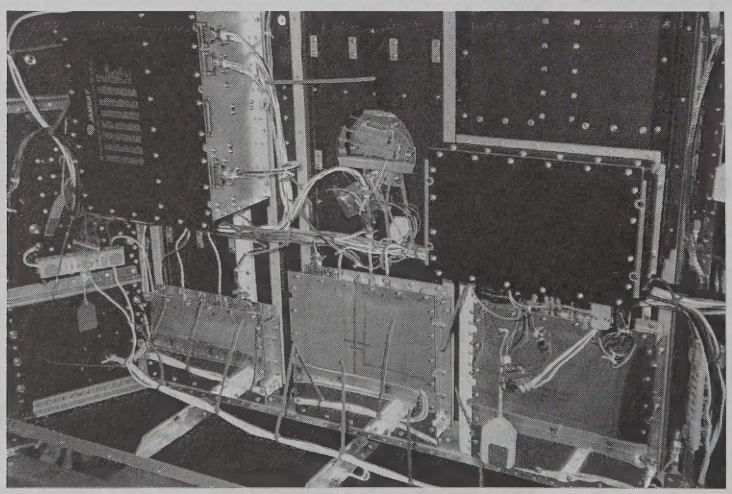
Gerd Shrick, WB8IFM, displays Phase 3D's stable mode Sun sensors prior to their final cleaning and installation into the spacecraft. A prototype of the sensor measuring fixture is shown at lower left. The sensors help determine the satellite's physical orientation in space for tracking and motor burn considerations. (AMSAT-NA photo by Keith Baker, KB1SF)



A large number of Phase 3D's *flight ready* communication modules are visible in this photo of Equipment Bay No. 3. Shown from top left are the Phase 3D S-Band transmitter #1, along with receivers for U- and V-Band, as well as Phase 3D's V/U band RF switching unit. Shown along the bottom (from left) are the U-Band transmitter exciter, U-Band combination modulator/high power amplifier, and V-Band transmitter. (AMSAT-NA photo by Keith Baker, KB1SF)



Dr. Karl Meinzer, DJ4ZC, AMSAT-DL President and Phase 3D Project Leader (l), listens intently while AMSAT-NA's Dick Jansson, WD4FAB, makes a point about the spacecraft's thermal design during a recent meeting at the Phase 3D Integration Laboratory. (AMSAT-NA photo by Keith Baker, KB1SF)



Some of Phase 3D's *flight ready* electronic modules are visible from Equipment Bay No. 2. Shown from top keft are JAMSAT's SCOPE camera experiment and the satellite's second S-band transmitter. Shown along the bottom (from left) are the L-Band, S-Band, HF-Band, and C-Band receivers. (AMSAT-NA photo by Keith Baker, KB1SF)

(ASSP) This is an important system for the purpose of keeping the solar panels and the antennas aligned, since the spacecraft is not spin stabilized but depends on momentum wheels, dampers and the tiny arc jet motor for maintaining the proper attitude. It consists of two Earth and 16 Sun sensors. My task was to calibrate the sun sensors and provide the proper amplifier settings for the system to work in space. We were shooting for 90 percent of the maximum reading and were assuming that the Florida sunshine provided 65 percent of the radiation that would be received in space. Sometimes readings had to be halted to let some clouds go by and we liked best the days with clear sunshine. While I developed a suntan, No. 30 sunblock was provided by the lab! With the tan it was hard for me to explain that I was *working 6-days a week* (hi).

In the meantime, module after module were installed and checked out. Eventually, telemetry was tried and it was fascinating to hear once more the 400 Baud sound that we were so familiar with from AO-13, but without any fading! The digital experts would come in and spend a few days mostly sitting at their laptops and getting their software to communicate with the rest of the satellite. So intense was their concentration that they preferred not to be interrupted by going to lunch but rather have some sandwiches brought in.

AMSAT-DL brought all their main players to Orlando and I spent a lot of time with them in and outside the lab. Of course, being originally from Germany myself and being quite familiar with the language and customs helped. Most of the guys had been with the Phase 3 program from the start and it was fascinating to listen to the stories they could tell.

There is a lot of documentation involved with such a big project and Wilfried Gladisch is doing a super job of keeping things up-to-date. He started doing this at the Marburg Lab with Phase 3A and at the time nobody appreciated it. " The next satellite we build, will be entirely different" he was told. You know what happened; Phase 3A hit the drink and immediately there existed a need for a quick replacement! Were they happy to have all the detailed drawings? You bet! That generated Phase 3B which became AO-10 and was then followed by Phase 3C, our last big one. These three were practically identical, with, of course, some

improvements. And would you believe, even Phase 3D has many features that were tested and proven on the earlier birds. Wilfried keeps track of this and is indispensable for the project.

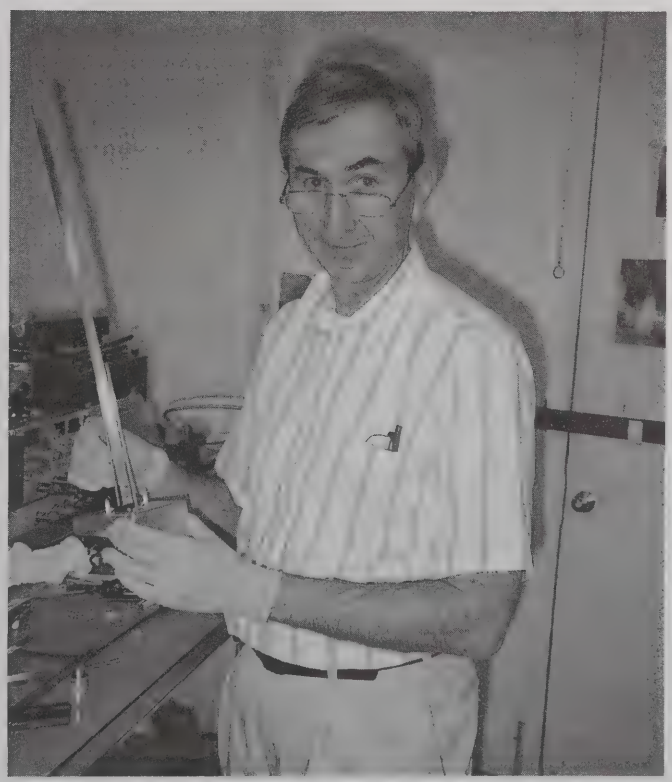
If you have a mechanical problem, possibly with parts that can only be appreciated with a magnifying glass, you talk it over with Konrad Müeller, called Konni, and very quickly he will assesses the situation and surprise you with the comment: "No problem!"

Also at the Orlando Integration Laboratory was Dr. Karl Meinzer, DJ4ZC, Phase 3D project leader and Director of the Marburg Facility. In the 1980s, Karl thought about a release mechanism which Konni then built in his machine shop. The two then traveled to an ESA conference in Toulouse, France and presented their creation. A lot of interest was generated and it resulted in getting AMSAT-DL firmly engaged with ESA, leading to a number of successful (and affordable) satellite launches. By the way, both Wilfried and Konni had no Amateur Radio experience. They had been too busy to get involved in *operating*. However, Konni took some classes; he was the oldest one there, passed the test and is now DG7FDQ.

These are just a few stories and impressions from spending a few weeks at the Phase 3D lab at Orlando. By no means is this the complete picture. There would be many more players to be mentioned and their specific contributions described. Help at the lab is always appreciated. Particularly from a few hams who live in a 50 mile radius of the lab and spend many of their weekends helping out. Visitors are always welcome and usually get a brief but complete tour of the lab (photo ops included), the visitor book is filled with names and calls from all over the world. If you are in the area, stop by and say hello, better yet, arrange for some time you could spend at the lab to help with their chores.

So, when is Phase 3D going to fly? Really, nobody knows yet. The next Ariane 5 (No. 503), still declared an experimental flight, is now scheduled for July 1998. We might be on this flight, but then some commercial customer might push us aside yet. Let's be patient and let our folks at the Orlando Integration Laboratory do their job readying the bird. ■

Michael Fletcher, OH2AUE (r) and Harri Leskinen, OH2JMS (l) pause for a moment just after installing and testing Phase 3D's 10 GHz transmitter and Traveling Wave Tube (TWT) amplifier. The TWT, procured by AMSAT-DL, delivered nearly 60 watts input into its *upside down paint bucket* dummy load (shown at top center) during tests. (AMSAT-NA photo by Keith Baker, KB1SF)



AMSAT-NA VP for Engineering, Stan Wood, WA4NFY, puts the finishing touches on Phase 3D's V- and U-Band omnidirectional flight antennas in preparation for their installation on the spacecraft. The V-Band antenna is constructed from the same anodized, flexible *carpenter's rule* material that has been succesfully flown on a number of previous AMSAT spacecraft. (AMSAT-NA photo by Keith Baker, KB1SF)

A Simple Receiver Kit and 10M Preamp For RS-12

John A. Hackett, LA2QAA
la2qaa@amsat.org

RS-12 has in recent months become even more popular among experienced satellite operators. This in turn leads to interest by the potential newcomer. Some newcomers have a 2m rig but no HF equipment. An easy way for a newcomer to try mode-A (2m uplink/10m downlink) is to purchase a 10m receiver kit. By so doing, one doesn't have to purchase a multiband transceiver just to receive RS-12's downlink.

A look through the available Amateur Radio literature turned up an advertisement for a beginner's SSB/CW receiver kit by C.M. Howes Communications (Figure 1). I telephoned the company and spoke to Chris Howes, enquiring about the suitability, price and etc. Chris was extremely polite and helpful and dispatched the DC2000 kit immediately. On arrival I was pleasantly surprised at the quality. Being an experienced constructor of 20 years or more it was refreshing to see a kit designed for the novice to both the bands and the workshop. Let it be said right away...anyone with only the very basic soldering skills can complete this project successfully providing the instructions are read, digested and followed.

All components were checked against the parts list and found to be correct. The hardware package was also purchased and this included everything needed for a complete direct conversion receiver.

The circuit design is as follows.....a combination of high and low pass filters followed by an active product detector. No pre-amp is included but if you live in a quiet RF environment you don't need one! The VFO is a FET oscillator. Some may frown at the use of a single FET with no buffer stage but the design and components used ensure a signal stable enough for 10m. In fact, the slight drift at warm up is consistent with RS-12's Doppler so is in fact you get a little bonus!

The bandpass filter and VFO are built on a separate board that plugs into the main circuit board. This gives the advantage of being able to use the receiver on any band from 80m to 10m. Different band modules can be purchased as extras separately. However, if you're only interested in RS-12, specify the 10m module. The product detector is followed by an RF filter, an IC audio pre-amp, volume control and IC audio amp. The audio is more than enough to drive an external speaker...though being a budding satellite operator you will undoubtedly use a pair of *ear mufflers*.....(headphones)....standard 8 ohm.

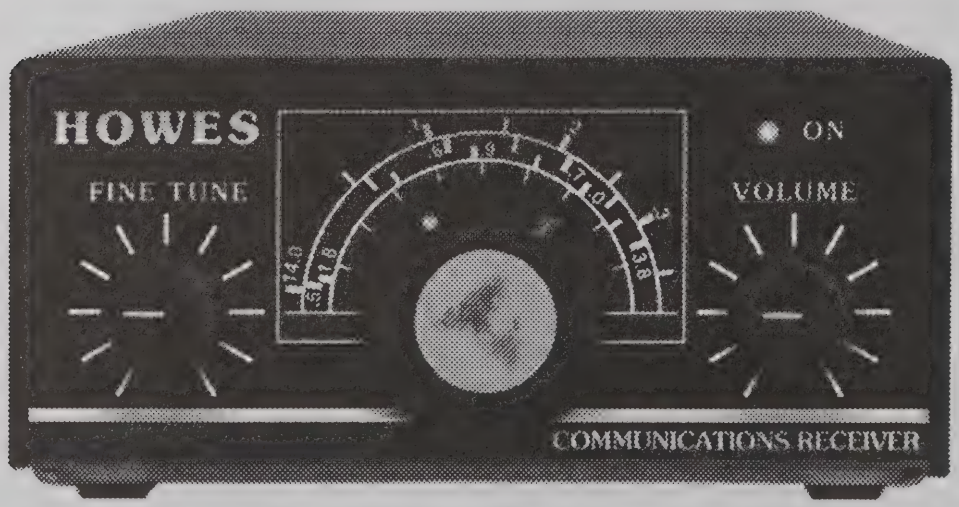


Figure 1. C. M. Howes Communication DC2000

The 1496 product detector is a well proven device. The days of the 10 pin package are gone. The one supplied is a 14 pin dual-in-line type. The FET VFO transistor is a fairly robust device but care should be taken not to overheat it. I recommend using a 15w soldering iron for the components and a 40w iron for the hardware connections, particularly the SO239 antenna plug.

The kit is very easy to build and align. A frequency counter or another receiver is all that is needed. I connected a frequency counter between pin 10 of the product detector with the return lead connected to the stator of the variable capacitor. A slight retune of the VFO coil and I was on 29.408 MHz...which is RS-12's beacon frequency. Note that when the lid is fitted the frequency rises by 240 kHz! Therefore, tune the VFO coil to 29.168 MHz then when you put the lid on you'll be right on frequency! Of course this will vary somewhat due to stray capacitance in the circuit, lead layout,etc. A point to remember is to keep all leads as short as possible consistent with keeping RF away from Vcc.

While the variable capacitor provided is adequate for 20m and below, on 10m I recommend the use of an air spaced variable capacitor of the Jackson type or similar since there is no VFO buffer. I used a 20pF type with a 6:1 reduction drive...(not included in the kit)....to give the VFO the best possible chance of stability. The audio amplifier has the correct amount of gain for the job. Some poor designs use far too much gain leading to howling noises and popping. Due to the solid case and good design the receiver doesn't suffer from ringing as a lot of DC receivers do when jolted.

A couple of nice touches were the tinned terminal pins and the case lid being left blank, allowing the constructor to use a finish compatible with existing equipment. The front panel is very nice, black with white lettering. There is a main tuning knob, a volume control and an RIT (receiver incremental tuning) allowing an offset of about 2 kHz. (This can be altered by changing the value of the resistors if you want to be finicky! But isn't necessary.) I feel the knobs could have been a slightly

better quality but the ones that are provided with the kit do the job!.

Each of the two PCB's is tinned and silk screened with component layout. The boards are fiberglass and are well made.

The instructions, including tips for soldering, are clear and concise.

The kit is at least as good as the now ancient HW8 with a lower component count but to be fair they didn't mass produce 1496's in DIL packages when the HW8 came on the market.

The following drift after warm up was measured on a Hewlett-Packard 600 MHz frequency counter after:

- 2 minutes.....29.408.80
- 3 minutes.....29.408.77
- 4 minutes.....29.408.70
- 5 minutes.....29.408.61
- 6 minutes.....29.408.56
- 7 minutes.....29.408.50
- 8 minutes.....29.408.44
- 9 minutes.....29.408.39
- 10 minutes....29.408.36

The company also offers several other kits and accessories. An interesting one for the satellite operator is the 10m transmitter which can of course be used as an exciter for microwave equipment for the Phase 3D satellite.

A complete QRP station (with band modules of your choice) receiver, transmitter and hook-up circuitry including all hardware and etc. can also be purchased. The catalogue contains a multi-band receiver as well as frequency counters, tuners and filters.

The price of the DC2000 receiver kit is £22.90 (about $38.00 USD). The hardware case, knobs and etc (HA22R) is £18.90 (about $31.00 USD). Postage is extra so telephone or e-mail Chris Howes, G4KQH for the current price delivered to your part of the world at:

C.M. Howes Communications
Eydon Daventry
Northants NN11 3PT
England
Telephone: 44-132-726-0178.
WWW: *http://www.howes-comms.demon.co.uk/*

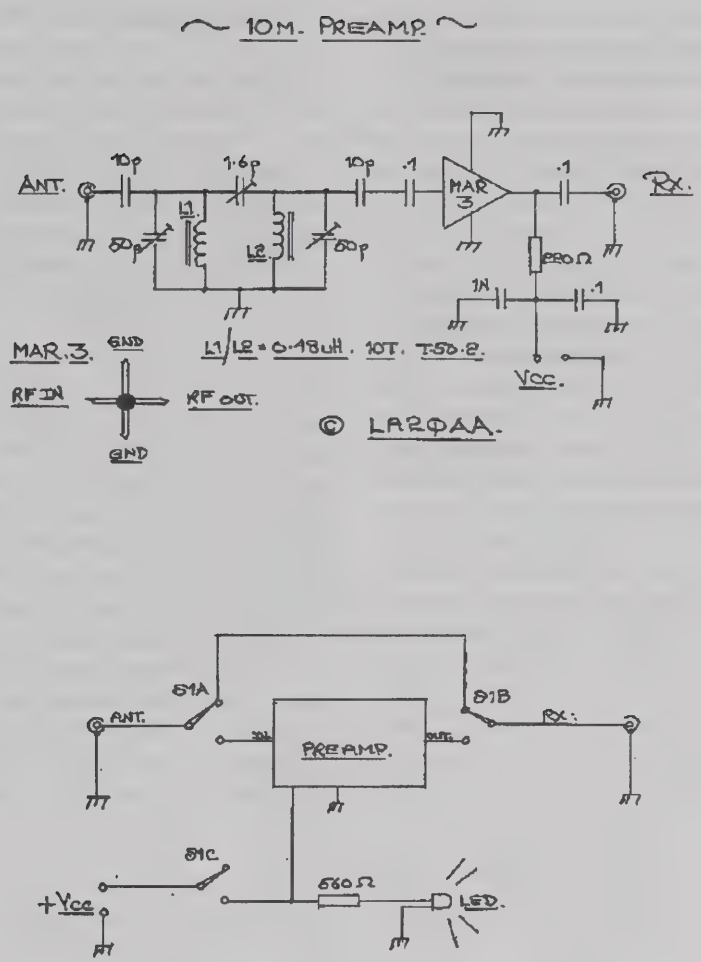


Figure 2. 10M Preamp

For those wishing to try RS-12 without selling the house, I can recommend the 10m DC 2000 receiver. For the record, I have no association with the company and the above is my unbiased opinion.

A 10m Preamp

In the evenings the RX is prone to broadcast break-in. There are commercial filters available from various sources but why buy them if you can make them. Normally I use digital bandpass filters but these are not recommended for the novice to construction. Therefore I built a simple pre-amp using a passive bandpass filter followed by a monolithic microwave integrated circuit (MMIC).

MMIC's have usable gain from DC to daylight and are extremely *user friendly*! They are extremely small so I don't recommend your usual brazing equipment or a blow torch! A 25 watt iron should be the maximum, heatwise.

Most MMIC's are terminated at 50 ohms which makes them easy to use for the amateur. All they require *outboard* are blocking capacitors and a bias resistor. The one I used was a MAR 3 which has a gain of 18 dB. The passive bandpass filter has a loss of approximately 8 dB so the gain of the pre-amp is 10 dB (nice) more importantly, the BPF/pre-amp completely gets rid of all broadcast break-in.

The filter is a doubly tuned, capacitively coupled band pass filter terminated with capacitors to ensure a 50 ohm impedance. Strictly speaking, at 10m one should use T.50.10. (black) powdered iron toroid material. However, since I didn't have these in my junkbox I used T.50.2. toroids (red)...normally used in the 14 MHz range. One could also use T.50.6. material (yellow)...21 MHz range. The idea being to have an inductance of 0.48uH. Be aware that different batches of the same material can vary a lot inductance wise! Therefore use trimmer capacitors as opposed to fixed standard values. (One could of course elect to use fixed capacitors with variable inductors wound on slug tuned formers but these often require shielding, whereas toroids don't). A small capacitor couples

the two tuned circuits, defining *the Q*. 0.1uF blocking capacitors are used at the in and out pins of the MMIC amp and 0.1uF and 1nF are used as bypass capacitors in the Vcc line. The bias resistor used is a 220 ohm quarter watt type. I built a little printed circuit board measuring 80mm x 35mm and enclosed it in a small homemade box. A 3x2 rotary switch provides *through switching*....(pre-amp off)....or pre-amp *on* with a LED to remind me whether it is in fact on or off. (Regular readers will be aware of my phenomenal memory!) The pre-amp could also be built *ugly style, but after my long engagement in Her Majesty's Service, I can't tolerate ugly* construction. See Figures 2 and 3 for details.

If you don't suffer from broadcast break-in you ***don't*** need this filter. However, if you do, you'll find this little project well worth the effort.

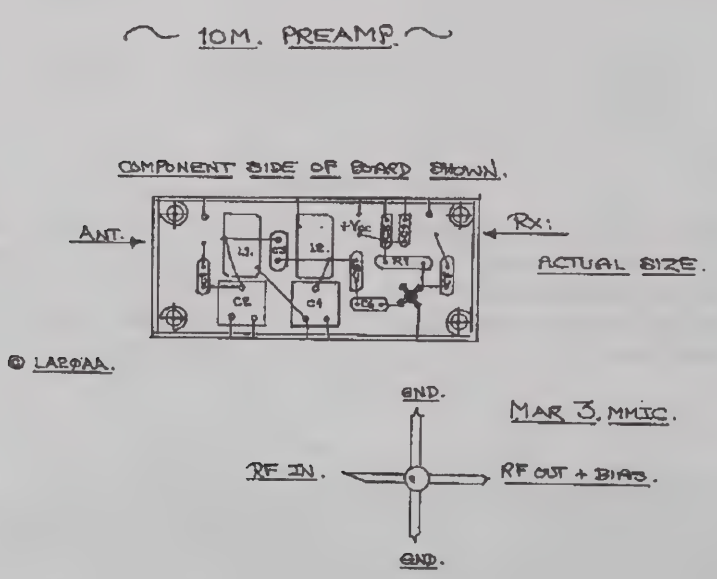
Observations from Norway

As Monty Python used to say...."*and now for something completely different*".....

Due to my recent trials and tribulations with the PSK attempt (failure!), I decided to concentrate on the 9600bps satellites. Now being *stuck* with one 2m rig that won't operate in the FM mode and another that won't *tune* while I transmit, (Doppler on FO-20 etc.) I could only *receive* the broadcast mode from the 9600bps birds. On reading the latest Weekly Satellite Report, the first thing I noticed was KO-23's downlink efficiency is approximately 1 percent!. Oh well....back to FO-20 and QRP. And you thought Murphy was Irish! He may well be but he lives in Norway! By the way, I did see GM4ULS's message title to LA2QAA on the KO-sats but I could not read it since I was unable to connect and since I could only receive broadcast mode. Murphy of course decided that the fragments of the message I needed to complete it were never transmitted. I'm still working on the problem so by the year 2001 I may be able to connect and *fill the holes*. [Had *herself* had the good sense to give me a shiny new FT 736R as a Christmas pressie...instead of the proverbial black laced underwear...(!)...I wouldn't have this problem with the Pacsats.]

Russ, KC5JVB telephoned me from Mississippi to congratulate and inform me that LA2QAA (absentee!) at the annual AMSAT-NA dinner, had been presented with a plaque suitably inscribed for *services rendered*. (My words as I am too embarrassed to repeat the *citation*!) I was also invited to the *do* AMSAT-NA get-together next October in Vicksburg, Mississippi. (I can't afford a local bus ticket let alone a joy ride on Concorde! Actually, they still use *Tiger Moths* over here!) I was of course delighted with the gesture as it is always nice to know that one's efforts are appreciated. Of late there are a lot of AMSAT knockers but personally I'm very proud to be a member of AMSAT and will continue to support the .org to the best of my ability. I will of course write a correct letter of appreciation to those concerned but I would, with our editor's permission, like to say a humble *thank you* to all of you whom by Packet, snail mail and QSO have given me so much positive feedback for *Observations*. I really do appreciate your support.....THANK'S CHAPS! NB: Russ, military correct as always made me stand to attention while he read out the inscription over the phone! And fool that I am, stood to attention! I told you I was proud to be a member of AMSAT!

After having moved into the permanent QTH from the hotel next door I've been using *real* antennas again. I stayed up late last night to catch the late night/early morning pass of FO-20 (local time 0115 hrs) specifically to see how the antennas performed on a *quiet* transponder with relatively low power. I'm now feeding the line with 10w RF from the old 700G allowing for 3dB line loss. I still haven't laid out the RG-214 and I am only using RG 58 which isn't much better than the XYL's nylon clothes line! With the 13dB gain antenna on 2m I have a (theoretical!) EIRP of 80w on two passes last night/this morning and three today. And, I've never heard my own downlink so strong. Obviously the experienced operator knows it, but perhaps the newcomer doesn't, an effective antenna is always better than a poor one stuck on the end of a linear. I can



COMPONENTS.

R1	=	220 Ω, 1/4W
C1.C5.	=	10pF.
C2.C4.	=	3~50pF trimmer.
C3	=	1~5pF trimmer.
C6.C7.C8.	=	0.1uF.
C9	=	1nF.
MMIC	=	MAR.3.
L1./L2.	=	0.48uH. (10T. T.50.2.)

Figure 3. 10M Preamp Housing and Compents List.

understand the apartment dweller with the J-Pole needing an amp to boost the signal up to 20 or 30 watts but I ***cannot*** understand why the chap feeding his 19 element Tonna with 50 watts of RF complains of a poor downlink. Surely if he's taken the trouble to erect such an antenna he must realize you also need an antenna to receive...or am I assuming too much? The 20w linear (?) is now being used extensively as an *harmonic generator* for microwave testing.

Even the best of them.....after the recent bouts of BBS problems (out of function...no KEPS! etc).....I decided to take the plunge and head for "them thar'ills".....The Internet. Not wishing to be a participant in the debate as to whether Internet Hams are *real* Hams or not....(I've been playing with radios for 32 years.)....I thought I'd just tell you why I decided to *plonk* the keys again. (Not that key-plonking is anything new to me...having been an avid RTTY'er since Moses lugged his chunks of stone down the mountain) I've never been one for *chatting* to demented mailboxes so I've always leaned toward analogue satellites as opposed to the digital birds. (Even though I *tried my hand* so I would at least have a working knowledge of these sats.) Obviously, to get the best out of a relatively fast moving LEO such as FO-20, one needs to track it. And to track it one needs KEPS...normally one collects the KEPS from the local BBS.....However, in my particular case the when *local BBS* is down we simply can't digipeat through the next chap along the route as we have mountains on three sides and the Norwegian Sea on the fourth....(now you know why I'm a satellite operator). In fact just getting up the mountain in the *summer* months is quite a feat. So, what do we do to stay in the race? Wait until *The AMSAT Journal* and *Oscar News* arrives? Or do we *modernize* and collect Keplarian elements *straight from the horse's mouth*. I've decided to pursue the latter course but not, I repeat ***not*** at the expense of the analog satellites. In fact, this *operation* is only a stop gap until Phase 3D is up and running at which time I will undoubtedly *migrate* to mode U/S....since I believe that's where the *bulk of me' mates* will eventually congregate.

Right! I have had Internet access for three days now....a very useful tool indeed...particularly for AMSAT business....keeping me' eye on Fred and Russ, collecting fresh KEPS and visiting the various interesting AMSAT sites. ***But*** for those contemplating *having a go* who don't have a *guardian angel* (he knows who he is) and have rather *outdated* gear.....BE WARNED!.....the 24 hour helpline service (at least here) is manned by totally! incompetent staff. The following is absolutely true.

Having just upgraded from a 286 tin can to a nice 386 with Windows 3.1, I felt prepared to take the leap into the future....The Internet. (OK, I know! But the XYL can't afford a 300 MHz Super Pentium. And anyway, a 386 taxes my brainpower.) I waltzed off to my local Tele-emporium.....(a 10x10 foot "cabin" on the mainland)....and proudly proclaimed I'd come to purchase an Internet subscription. After stating the equipment I had (386 PC + Windows 3.11) IMPOSSIBLE said the sales-person you MUST! have a MINIMUM of a 486 PC running Windows 95 to be able to access the Internet! Are you sure!...(said I)...definitely!...(said he). So I asked why June 1994 Oscar News issue contains an Internet e-mail address *R.Broadbent@EE.SURREY.AC.UK*? This stopped the gentleman dead in his tracks. After realising *the rest of the world* used Internet a bit before Windows 95 came to Norway in 1997, I was then told the

"modem" system would not work at all with a 386. (What do you suppose they all used before ISDN and double lines came along?) Anyway...against the advice of the *expert* I purchased a modem and subscription. (Which works perfectly now; thank the Lord I'm a radio amateur.) On attempting to connect to the network I noticed the telephone number was in Oslo! (They use Trondheim up here.) Of course...no connect...just a tinny female voice telling me I was trying to connect to a number that didn't exist! Call "support. ....ahhh yes!.....you have to change the setup. How do I do that? I don't know, you'll have to phone Oslo. Phone Oslo...how do I change the telephone number?....You can't! We have to do that....do it then! Sorry, no staff here on Friday. But I've paid for 24 hour service and support! Sorry, call tomorrow. Called tomorrow...different gentleman, same story.....sorry, don't know how to do that, you must call the people who sold you the software...Did. "Sorry, we don't know!".

To cut a long story short, I called LA5QIA.....(AMSAT, naturally)...and was immediately told how to change the number using the WDIAL file. As I said lucky for me there are Radio Amateurs around as opposed to *professionals*...some whom haven't got the foggiest about the gear they're selling to the unsuspecting public.....(who blindly trust the salesman's competance) So if you're contemplating setting up with gear that is older than three days....BE WARNED! Ask a lot! of questions. These *observations* are based on an opinion from one who lives on the *wrong side* of the North Sea. For your sakes, I hope the service is better on the right side.

A very good friend of mine (no names mentioned) in humorous exasperation commented...."It seems the only way we're going to get Phase 3D launched is by using *knicker elastic.* Gentlemen, please inform the XYL/girlfriend that her *smalls* are a very important item and are necessary to the advancement of science. Anyone volunteering to coordinate the *Knickers for Phase 3D* fund please contact LA2QAA.

Just worked Dave again G1OCN on FO-29 and we had a real good (belly?) laugh. As we began the QSO some clot started with the belly-ache sounds swishing from side to side across the frequency. Quite spontaneously Dave burst out laughing...which was infectious and I followed suit. I suggested that the white stuff in the blue bottle (milk of Magnesia) would perhaps help the sufferer. Strangely enough the QRM ceased but I couldn't carry on the QSO due to the tears rolling down my leg! Nice one Dave! Perhaps you just found an effective cure to combat those operators who need to broadcast their afflictions...(stomach ulcers)...via satellite transponders. The satellite is well below the horizon now but I'm still laughing my socks off. I just know that everytime someone pops up with an *aarrgghhh* I'm going to collapse in tears of laughter.

For those that don't already know, K2UBC's new edition of *The Satellite Experimenter's Handbook* is now available....this is the BIBLE for the satellite enthusiast! Marty Davidoff's new edition contains several things not available in the old version and should be on the bookshelf of every experienced or would-be satellite operator.

EUROCRATS?....It's the same the whole world over. A few weeks ago I telephoned the R.A.'s office in Bristol enquiring how to go about applying for a UK callsign. Since I was born and bred in Crewe and have always maintained a current British passport I assumed there would be no problem. The polite and helpful young lady in Bristol confirmed this saying all I needed to do was to send the necessary fee together with my current Norwegian license. However after 28 years in Norway, I'm quite used to bureaucratic procedure so decided to also enclose a cover letter explaining my situation with regard to NATO Oslo, my current passport Nr:, ditto birth certificate, Norwegian license and fee....(Assuming that would be enough to prove I really was/am a Brit.) Two weeks later a letter from London!...can't find your address...(which was clearly printed on the covering letter AND application)....wrote back once again explaining and giving my last address in the UK...also stating that if there was a problem I could in fact manage quite nicely without a U.K. callsign...in which case please return the fee and my Norwegian license.

Yes, you've guessed, they returned my cheque and license. Apparently, the powers that be allow British subjects to serve in Her Majesty's Forces abroad, serving their country, but won't grant them an Amateur Radio license unless they can offer an *address* in the U.K. I could of course complain (as a British citizen) but can't be bothered! And anyway, would anyone care? Just thought I'd put on record some of the decisions of the higher echelons of those *running the show*. Did someone say "fighting the cold war for a peacetime dividend?" Therefore I will continue to sign LA2QAA as opposed to M something or other.

More on power, or rather, lack of it! Today on March 10th, I worked Malc, G7NFO as usual on FO-20. The conditions were really good, especially on the second pass of the day. I mentioned that it was just like being on the telephone and Malc responded just like you're sitting here in the shack. Malc QRP'd to 2.5 watts and I had perfect Q5 copy. I'm ashamed to admit I was running QRO (5 watts!). One of these days a few more people will (hopefully) realize that high power really isn't necessary on LEO's.

I've just built the Howes DC 2000 receiver for RS-12...a simple kit that works just fine. See the review earlier in this article. As an experienced constructor it was quite refreshing to go back to basics and try this particular receiver. In fact the novice gets a bonus! The drift LF is equal to the average Doppler shift on 10m which means anyone building the kit won't have to tune for Doppler! Anyone suffering from Radio Canada break-in can add a bit more front end filtering and optional pre-amp. The DC 2000 works just fine for RS-12 using a dipole thrown over the balcony. For anyone contemplating construction for the first time...I can thoroughly recommend the kit.

A STAR IS BORN....well, just a little one! After a couple of false alarms at the hospital, the XYL finally *launched* junior satellite operator Nr: 4. Then there was the *in-fighting* regarding names for a brand new female species. In good Star Trek tradition, I had suggested *Phase 3D*, but the XYL replied that was the fastest way for her to become an X-XYL. I tentatively tried another *track* but she said you can't call a girl *Oscar*! Oh well, we will probably end up with something traditional like Bodecia Bloggs. - 73, John, LA2QAA

Editor's Note: Emma Emelia Hackett was born April 22, 1998 in Kristiansund, Norway. She weighed in at 3.125 Kg and was just a bit longer than a 2-meter quarter wavelength (50 cm). ■

AMSAT VHF and HF Nets

Andy Reynolds, WD9IYT

VHF/UHF Nets

Net	Day	Time	Frequency (MHz)	Location	NCS
AMSAT DC Net	Monday	2000 Local	145.350	Washington, DC	John Klim, N3KHK
ARK-LA-TEX Net	Monday	1930 CST/2000 CDT	146.670	Shreveport, LA	Roger Ley, WA9PZL
Boston Heavy Hitter	Thursday	2030 Local	146.640	Waltham, MA	Ernie MacLauchlan, K1ELA
Central New York	Monday	2000 Local	146.880	Rome, NY	Randy Baker, WA2EXJ
Colorado AMSAT Net	Wednesday	2000 Local	147.225	Denver, CO	John Gubbins, N0VSE
			145.460	Boulder, CO	Rick Vebrum, KB0VBZ
			224.980	Colorado Springs, CO	
Cowley County AMSAT Net	Sunday	2000 Local	145.190	Wichita, KS	Ron Smith, N5SMJ
Fort Worth/Dallas	Wednesday	2100 Local	147.140	Fort Worth, TX	Doug Howard, KG5OA
Houston AMSAT Net	Tuesday	2000 Local	147.100	Houston, TX	Andy MacAllister, W5ACM
Inter-State Repeater Society	Friday	2000 Local	146.850	Derry, NH	George Caswell, W1ME
			224.460	Derry, NH	
			449.625	Derry, NH	
Long Island AMSAT Net	Tuesday	2000 Local	147.210	Long Island, NY	Ken Ernandes, N2WWD
			147.075	Long Island, NY	
Miss/Lou AMSAT Net	Thursday	2000 Local	147.270	Vicksburg, MS	Eddie Pettis, N5JGK
Mt Washington AMSAT Net	Tuesday	2000 Local	146.655	Mt. Washington, NH	George Caswell, W1ME
Relay of Houston Net	Tuesday	2100 Local	442.600	York, ME	George Caswell, W1ME
			446.575	Boston, MA	
			442.000	Fitchburg, MA	
			224.840	Tiverton, RI	
			442.600	Tiverton, RI	
Southeast MI AMSAT Net	Tuesday	2000 Local	145.330	Dearborn, MI	James French, KD4DLA
			224.580	Dearborn, MI	
			442.800	Dearborn, MI	
			1282.050	Detroit, MI	
Southern Arizona Net	Wednesday	1900 Local	146.280	Tucson, AZ	Larry Brown, NW7N
Southwest Ohio AMSAT Net	Tuesday	2000 Local	145.110	Dayton/Columbus, OH	

HF Nets

Net	Day	Time	Frequency (kHz)	NCS
AMSAT East Coast Net	Tuesday	2100 Eastern	3840	Al Tribble, W3STW
Mid-American Net	Tuesday	2100 Central	3840	Keith Pugh, W5IU
West Coast Net	Tuesday	2000 Pacific	3840	Cliff Buttschardt, K7RR and Jim Shepard, K6OOY
20M International Net	Sunday	1800 UTC	14282	Keith Pugh, W5IU and Wray Dudley, W8GQW
15M International Net	Sunday	1900 UTC	21280	Wray Dudley, W8GQW and Jack Butler, KB7UZ

1998 AMSAT Field Day Competition

Andy MacAllister, W5ACM
(amacalli@danielind.com)

Field Day is once again just around the corner beginning at 1800 UTC on June 27, 1998 for a 24-hour period. We are proud to announce the 1998 AMSAT Field Day Competition. It is open to all Amateur Radio operators. U.S. and Canadian amateurs are to exchange ARRL section and Field Day transmitter class. Foreign amateurs should exchange country name and signal reports. Last year's effort was very successful. The AMSAT competition is to encourage the use of all amateur satellites, both analog and digital. CW contacts and digital contacts are worth three points as outlined below.

Here are the rules for the 1998 AMSAT Field Day competition.

Analog Transponders

- Each satellite transponder is considered a separate band.
- All phone QSO's and all CW QSO's on a given satellite transponder are considered separate bands.
- All packet/RTTY/ASCII/AMTOR QSO's through analog transponders are counted as CW QSO's.
- Phone QSO's count for one point and CW QSO's count for three points.
- Cross-mode (CW/phone) contacts are not allowed.
- The use of more than one transmitter at the same time on a single satellite transponder is prohibited.

Digital Transponders

For the Pacsats (LO-19, KO-25, etc.) each satellite is considered a separate band. Do not post "*CQ*" messages. Simply upload ***ONE*** greeting message to each satellite and download as many greeting messages as possible from each satellite. The subject of the uploaded file should be posted as Field Day Greetings, addressed to ***ALL***. The purpose of this portion of the competition is to demonstrate digital satellite communications to other Field Day participants and observers.

The following uploads and downloads count as three point digital contacts.

(a) Upload of a satellite Field Day Greetings file (one per satellite).

(b) Download of Satellite Field Day Greetings files posted by other stations. Downloads of non-Field Day files or messages not addressed to ALL are not to be counted for the event. Save DIR listings and message files for later *proof of contact*.

Satellite digipeat QSO's do not count for any score and the use of gateway stations to uplink/downlink is not allowed.

The MIR PBBS is not to be used for Field Day operations.

If FO-29 is active, the JA transponder can be used for analog CW and phone activities under the analog transponder rules, and the JD system can be used as a separate transponder under the digital rules.

Sample Satellite Field Day Greetings File

Greetings from K5DX Field Day Satellite station near Brenham, Texas with 20 participants, operating class 2A, in the AMSAT-Houston group with the Texas DX Society. All the best and 73!

Note that the message stated the call, name of the group, operating class, where they were located (the grid square would be helpful) and how many operators were in attendance.

Operating Class

Stations operating portable and using emergency power (as per ARRL Field Day rules) are in a separate operating class from those at home connected to commercial power. On the report form simply check off Emergency or Commercial for the Power Source and be sure to specify your ARRL operating class (2A, 1C, etc.).

The Satellite Summary Sheet (Figure 1) should be used for submittal of the AMSAT Field Day competition results to: *Andy MacAllister, W5ACM, Vice President User Services, 14714 Knights Way Drive, Houston, TX 77083-5640*. Make sure to also send your Field Day photographs with your submission as results will be printed in *The AMSAT Journal*! Deadline for submissions is August 1, 1998. You can also send your sheet electronically to *amacalli@danielind.com*.

Competition was tough in 1997, and there were some difficulties with various interpretations of the digital rules. When in doubt, don't count it. If your score is in the top five, you will be requested to submit dupe sheets for the analog contacts and DIR listings and downlinked files for the digital contacts.

The station submitting the highest score for portable operation using emergency power will receive a plaque at the AMSAT Space Symposium and Annual Meeting to be held in Vicksburg, Mississippi in October. Second and third place entries will receive certificates, as will first place in the home station with emergency power category.

We hope this event provides satellite operators with the practice necessary to set up a ground station a effectively operate via the satellites in an emergency situation. Remember that Field Day also provides a good opportunity to expose newcomers to the Amateur Radio satellites. Most of all, it should be a lot of fun for all who participate.

GL ON FD ES 73,

Andy W5ACM

Satellite Summary Sheet, AMSAT Field Day - 1998

Analog Satellite Operation Satellite/Mode	CW QSO's	Phone QSO's
Multiplier	**x 3**	**x 1**
Analog Subtotals		

Digital Satellite Operation

Satellite	Uploads/Downloads
Multiplier	**x 3**
Digital Subtotal	

Score Calculation

Analog CW Subtotal (above)	
Analog Phone Subtotal (above)	
Digital Subtotal (above)	
Grand Total	

Your Field Day Call Sign:
Your Group Name:
ARRL Field Day Classification: **Section:** _____
Power Source: **Emergency:** _____ **Commercial:** _____
Your Name and Callsign:
Home Address:

Comments:

Figure 1. AMSAT Field Day Score Sheet.

Radio Amateur Satellites Launched

Martin Davidoff, K2UBC

No.	Satellite Name	Year	Launch Country/Agency	Licensing Country
1	OSCAR I	1961	US	US
2	OSCAR II	1962	US	US
3	OSCAR III	1965	US	US
4	OSCAR IV	1965	US	US
5	Australis - OSCAR V	1970	US/NASA	US
6	AMSAT-OSCAR 6	1972	US/NASA	US
7	AMSAT-OSCAR 7	1974	US/NASA	US
8	AMSAT-OSCAR 8	1978	US/NASA	US
9	RS-1	1978	USSR	USSR
10	RS-2	1978	USSR	USSR
11	AMSAT P3A (FRG)	1980	ESA	Germany
12	UoSAT-OSCAR 9	1981	NASA	UK
13	RS-3	1981	USSR	USSR
14	RS-4	1981	USSR	USSR
15	RS-5	1981	USSR	USSR
16	RS-6	1982	USSR	USSR
17	RS-7	1982	USSR	USSR
18	RS-8	1982	USSR	USSR
19	Iskra 2	1982	USSR	USSR
20	Iskra 3	1982	USSR	USSR
21	AMSAT-OSCAR 10 (FRG)	1983	ESA	Germany
22	UoSAT-OSCAR 11	1984	NASA	UK
23	Fuji-OSCAR 12	1986	NASDA	Japan
24	RS-10/11	1987	USSR	USSR
25	AMSAT-OSCAR 13 (FRG)	1988	ESA	Germany
26	UoSAT-OSCAR 14	1988	ESA	UK
27	UoSAT-OSCAR 15	1988	ESA	UK
28	Pacsat-OSCAR 16	1990	ESA	US
29	DOVE-OSCAR 17	1990	ESA	Brazil
30	Webersat-OSCAR 18	1990	ESA	US
31	Lusat-OSCAR 19	1990	ESA	Argentina
32	Fuji-OSCAR 20	1990	NASDA	Japan
33	BADR-1	1990	China (PRC)	Pakistan
34	RS-14/AO-21	1991	CIS	CIS
35	RS-12/13	1991	CIS	CIS
36	UoSAT-OSCAR 22	1991	ESA	UK
37	KITSAT-OSCAR 23	1992	ESA	South Korea
38	Arsene-OSCAR 24	1993	ESA	France
39	KITSAT-OSCAR 25	1993	ESA	South Korea
40	Itamsat-OSCAR 26	1993	ESA	Italy
41	AMRAD-OSCAR 27	1993	ESA	US
42	PoSAT-OSCAR 28	1993	ESA	Portugal
43	RS-15	1994	CIS	CIS
44	UNAMSAT-A	1995	CIS	Mexico
45	TechSat-A	1995	CIS	Israel
46	Fuji-OSCAR 29	1996	NASDA	Japan
47	Mexico-OSCAR 30	1996	CIS	Mexico
48	RS-16	1997	CIS	CIS
49	Spoutnik RS-17	1997	CIS	France (Reunion)

Launch Summary (37 Years, 1961-1998)

Total Number Launched	49
Placed in Orbit	46
Launch Failure	3

Total Number of Launches by Launch Agency/Country

USSR/CIS	19
ESA	16
US (none since 1984)	10
NASDA (Japan)	3

Countries Licensing Radio Amateur Satellites

CIS/USSR	15
US	11
UK	5
Germany/FRG	3
Japan	3
France	2
Mexico	2
South Korea	2
Argentina	1
Brazil	1
Italy	1
Israel	1
Pakistan	1
Portugal	1
Totals	**49**

Summary prepared April 15, 1998 by M. Davidoff, K2UBC

Notes:

1. I did not include the SARA (French Radio Astronomy Mission).
2. I am not 100 percent certain of the radio licensing country for all spacecraft.

Satellite Orbital Elements

Ray Hoad, WA5QGD

Satellite	AO-10	AO-27	FO-20	FO-29	RS-10/11	RS-12/13	RS-15
Catalog Number	14129	22825	20480	24278	18129	21089	23439
Epoch Time	98118.08841211	98114.22113515	98119.26251536	98119.06373988	98119.14923372	98119.31506107	98119.08844819
Element Set	548	636	48	189	516	62	305
Inclination	26.773	98.5016	99.0739	98.5165	82.9271	82.9216	64.8213
RA of Node	90.6547	185.9581	26.8922	121.7357	5.1885	44.1963	2.0319
Eccentricity	0.6000897	0.0009509	0.0540926	0.035236	0.0013291	0.0030252	0.0146641
Arg of Perigee	212.2327	51.5488	22.095	87.3364	66.0169	133.9748	70.5786
Mean Anomaly	90.3717	308.6908	340.2536	276.8049	294.2378	226.3907	291.0922
Mean Motion	2.05880393	14.2776966	12.83243261	13.52641178	13.72394778	13.7409712	11.27529608
Decay Rate	-0.00000006	-0.00000042	-0.00000038	0.00000009	0.00000057	0.00000006	-0.00000039
Epoch Rev	11184	23845	38524	8382	54357	36257	13755
Satellite	RS-16	UO-11	UO-14	AO-16	DO-17	WO-18	LO-19
Catalog Number	24744	14781	20437	20439	20440	20441	20442
Epoch Time	98119.18197815	98119.01890966	98119.15688778	98119.16157686	98119.18570561	98119.19110467	98119.13243436
Element Set	203	62	371	156	143	158	153
Inclination	97.2563	97.8792	98.4907	98.5134	98.5191	98.5187	98.5226
RA of Node	23.545	93.3517	198.5564	202.2614	203.3892	203.2525	204.0547
Eccentricity	0.0008541	0.0013081	0.0011654	0.0011856	0.0011696	0.0012688	0.001292
Arg of Perigee	53.7932	78.7453	1.704	3.1369	2.7621	2.4794	1.4462
Mean Anomaly	306.41	281.5094	358.4181	356.9887	357.3628	357.6453	358.6756
Mean Motion	15.35285328	14.6973466	14.30013585	14.30056299	14.30201642	14.30165119	14.30285444
Decay Rate	0.00009992	0.00000255	0.00000076	0.00000062	0.00000077	0.00000056	0.0000005
Epoch Rev	6449	75764	43137	43139	43143	43143	43145
Satellite	UO-22	KO-23	KO-25	IO-26	MIR	HUBBLE	Phase 3D (Est)
Catalog Number	21575	22077	22828	22826	16609	20580	99934
Epoch Time	98119.13426714	98119.34198076	98119.16859429	98119.14072935	98119.08783220	98118.70567992	96260.25520000
Element Set	855	741	620	651	444	95	3
Inclination	98.2573	66.0787	98.5062	98.5099	51.6587	28.4697	60.0203
RA of Node	172.7437	203.2718	191.2129	191.083	295.1201	183.9396	342.7876
Eccentricity	0.0008465	0.0009464	0.0011199	0.001008	0.0004089	0.0014432	0.6752895
Arg of Perigee	29.6279	323.0226	20.9581	37.7421	287.8368	233.142	180.1221
Mean Anomaly	330.5396	37.0138	339.2059	322.4466	72.2216	126.7848	179.5089
Mean Motion	14.37135198	12.86309653	14.2823237	14.2788266	15.63868123	14.86717072	1.51063698
Decay Rate	0.00000057	-0.00000037	0.00000059	0.00000066	0.00008442	0.00000785	0.0002
Epoch Rev	35586	26841	20731	23917	69637	24005	2

Field Ops Update: Club Presentations

Barry Baines, WD4ASW (*wd4asw@amsat.org*)

As an AMSAT member, you will be facing a situation that has been experienced by other AMSAT members. Your local ham club knows that you are active with Amateur Radio satellites and wants you to share your knowledge and experiences with other members of the club. They've asked you to make a presentation at next month's club meeting. Your immediate reaction is to say 'Yes' since the idea of publicizing how great it is to work the satellites appeals to you. However, you start to have second thoughts since the idea of putting together a presentation from scratch doesn't sound like much fun. What do you do?

Fortunately, AMSAT does have some materials that you may want to consider using as part of your presentation. While each presenter must tailor his/her presentation to a particular audience and his/her own style, it makes things easier if one can adapt existing resources to the project at hand. Let's review some of the options that are available to you.

First, contact Martha Saragovitz, AMSAT's Office Manager, to see about obtaining some of the *What is AMSAT* brochures. This brochure provides a brief overview of the organization and includes a membership application form. It makes a good *take home* item that will hopefully result in some memberships. Contact Martha at AMSAT headquarters (301-589-6062) or via e-mail (martha@amsat.org).

Videos

Martha also has two relatively recent videos that you may want to consider using if a VCR and TV (suitable for the size of your audience) are available for your presentation. Many of you will recall the *Inside Space* program on the Sci-Fi Channel that highlighted Amateur Radio and the satellite program in particular back in March 1996. The producers have granted AMSAT permission to use this video for AMSAT publicity purposes. The 22 minute program includes an overview of SAREX, Phase 3D, AO-27 (including a demo that includes W3XO providing a 'new' name for a body of water along the coastline of Texas, hi!), and amateur satellite basics.

AMSAT also has a video of Phase 3D testing that was shot by KB1SF in March 1997, professionally edited by Terry Douds, WB8CKI and first shown at Dayton '97. It includes an overview of the Phase 3D satellite layout, discussion of the various components that make up the satellite, and shots of actual testing, including a demonstration of LEILA.

Should you need any of these items from Martha, please contact her at least three weeks in advance of your presentation. We also ask that you return the videotapes to Martha immediately after your presentation so that others may also use them.

AMSAT Web Site

AMSAT maintains both a web site (*http://www.amsat.org*) and ftp site (*ftp.amsat.org*) which house a number of resources that you may want to consider for your presentation. In the case of the AMSAT web site, you may first want to check out the *What is AMSAT* page under *AMSAT Information*. It provides a brief overview of AMSAT.

By all means, download the *Amateur Satellite Resource Guide* which can be found in the "FAQ and Introductory Articles" page. Written by Gary Rogers,WA4YMZ, and updated by Mike Seguin, N1JEZ in March 1998, it contains a listing of books, periodicals, ftp and world wide web resources, and a discussion of newsgroups and other resources. It is a nine-page document available in PDF format that you may want to consider using as a handout.

Steve Bible, N7HPR, has crafted eleven web pages concerning each class of current amateur satellite can be found under the *Satellite Information* category. Each page contains an overview of frequencies, features, and a description of each satellite (including a drawing). These pages make great presentation slides that you may want to incorporate into your discussion of current satellites. There are also pages available concerning future amateur satellites, such as SEDSAT.

AMSAT FTP Site

The FTP site contains complete presentation files that can be downloaded. Look in the *ftp.amsat.org/pub/amsat/presentations* area. This area houses formal presentations that have been developed by various AMSAT members and are available for members to use as well. There are two subdirectories in this area that I'd like to highlight. First, the *Phase3D* subdirectory contains copies of a presentation made by Ed Krome, K9EK (formerly KA9LNV) in various formats, such as Power Point and Corel Draw. Ed gave a talk titled *The View From Below: Thoughts on P3D Ground Stations* that was given at the 1996 Dayton Hamvention. It was also presented by Ed at the 1996 AMSAT Symposium in Tucson as well as by VK5AGR at the 1996 AMSAT-UK Colloquium.

Under the subdirectory *New*, you will find copies of various presentations given at the ARRL/AMSAT Satellite Workshop at Miami in January 1997. There are four different presentations provided, including *AMSAT: A Tutorial for Beginners*, *Using Amateur Radio Digital Satellites*, *Easy Sat Overview*, and *Satellite Tracking*.

By the time this article is published, expect to see several other presentations on the ftp site. One is *Introduction to Amateur Radio Satellites* by WD4ASW that was given at the 1998 ARRL/AMSAT Satellite Workshop in Orlando, FL this past February. It is an update to the *Beginner's Overview* given the year before. In addition, presentation materials by N7HPR (Digital Satellites) and WD4FAB (Phase 3D) from the Orlando workshop will also be posted. A copy of the AMSAT presentation given at the 1997 ARRL National Convention Dinner by WD4ASW which covers the history of amateur satellites and Phase 3D overview and status (as of 3AUG 97) should also be available.

AMSAT members who have prepared presentations and would like to share them with other members are encouraged to upload them to the ftp site. They should be placed in the presentations/incoming subdirectory. Send an e-mail message to Bob Walker N4CU at *n4cu@amsat.org* notifying him of the upload so that he can look for it. Bob will place the new materials in a read only subdirectory in order to make them available to others. In your e-mail message, you should let him know the presentation title, what format your presentation is in (Power Point, Word, Corel Draw, PDF, etc.) and provide a brief description of the contents. Bob can then place this information in an appropriate 'readme' file so users will know what they are downloading.

In summary, there are a variety of materials that you can access in order to make a first class presentation. Feel free to adapt these resources to fit the needs of your audience and your interests. And don't forget to share your results if you have created new presentation materials that will be of benefit to other members preparing for their own opportunities to publicize the amateur satellite program. ■

A Simple Dish for Mode-L

Dr. John L. DuBois, W1HDX

Editor's Note: This article originally appeared fifteen years ago in the March/April 1983 issue of Orbits, an AMSAT-NA publication prior to The AMSAT Journal. It is presented here for the general education of the reader. It illustrates one type of circular polarization feed which can be used with parabola-type antennas. One of the desirable features of the parabolic antenna is that it can be scaled for different frequencies and sized to accommodate gain requirements which in turn depend on available transmitter power (uplink) or LNA NF (downlink) and satellite parameters.

It is not intended that this exact antenna would be reproduced for Phase 3D purposes, for example, although it might be used for a Phase 3D L-band uplink even at this diameter if available transmitter power was limited. Many other articles on parabola-type antennas have appeared and continue to appear in this and other amateur publications.

Antenna requirements for communication through Mode L transponder of the Phase 3B satellite are not easy to satisfy with off-the-shelf components. Required minimum gain ranges from 12 dBi for 50 watts of transmitter output to 24 dBi for a 3 watt output at 1270 MHz. These values span the range from a single Yagi to an efficient dish antenna. Linear element and loop element Yagis for 1296 MHz are available but have insufficient bandwidth to work well in the 1296.15 to 1269.95 passband of the Mode L transponder.

If this isn't a sufficient impediment, then the polarization problems may discourage many potential users. To avoid severe fading from satellite spin and to match the spacecraft antenna polarization, it will be necessary to use right hand circular polarization in transmitting and receiving antennas. It is difficult to obtain circular polarization from currently available 1296 MHz Yagis. These are not built as two independent, interleaved antennas at right angles although this is common practice at 70cm. Loop Yagis are even harder to use for circular polarization since this would require two balanced and phased feeds to the loop radiator.

Consequently, I felt a small dish would represent the easiest type of antenna to construct for Phase 3B Mode L uplink as long as a suitable feed could be designed for circular polarization. For several years weather satellite hobbyists who have built stations to receive GOES series of geostationary satellites broadcasting on 1961 MHz have used a four foot diameter dish sold by Montgomery Ward for UHF television. This antenna is built from 3/16 inch steel wire welded into the shape of a parabolic dish. It comes knocked down in two halves with a separate dipole and reflector feed. It is designed to be assembled with the support mast across the front of the dish tied to the post holding the feed dipole. There have been many adaptations of this assembly for GOES use at 1691 MHz, and the basic parts lend themselves to mounting in a variety of ways.

This dish is sold by Montgomery Ward as catalog #63A19293R and was priced $39.95 in the 1982 catalog. It is 48 inches in diameter with a focal length of 18 inches giving an f/d of 0.375. If illuminated with 50 percent efficiency this would yield a gain of 21 dB at 1270 MHz with a -3 dB beamwidth of approximately 16 degrees. This kind of performance would match nicely to a 10 watt output transmitter at 1270 MHz; a power level which will soon be available from several sources in solid state.

Having decided on this basic reflector, it was necessary to choose a suitable feed system which could produce circular polarization. Here the experience of the EME community was helpful. Many EME stations use circular polarization at 70cm and shorter to combat the effects of Faraday rotation on their signals. A popular feed in EME use at 1296 MHz is a circular horn with two quarter wave stub radiators inside set at right angles and fed 90 degrees out of phase. This produces the required circular polarization and is inherently unbalanced for simple coax feed.

For Mode L use, all that was necessary was to redesign the feed for 1270 MHz and devise a suitable scheme to feed the two radiator stubs 90 degrees out of phase. In addition, it seemed desirable to build a mounting bracket which would not require the support boom to pass in front of the dish as in the original design. The last task proved easy, but the feed horn design turned out to require far more empirical adjustment than expected.

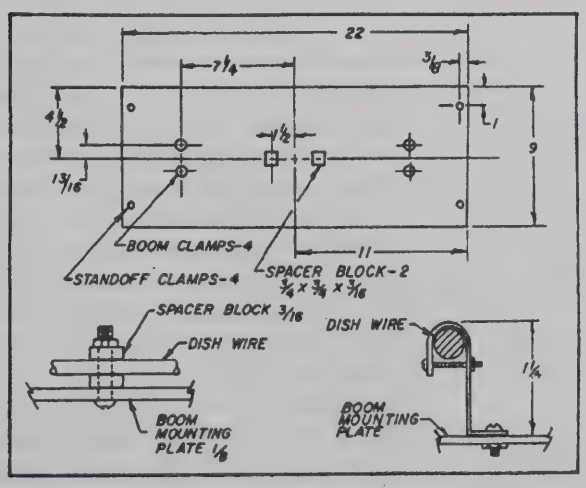


Figure 1. Dish mounting plate clamps and spacers. Dimensions are given in inches.

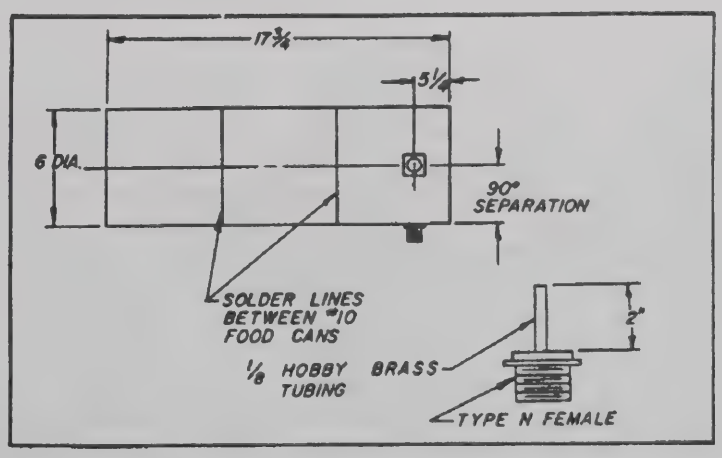


Figure 2. Feed horn and radiator probes. Dimensions in inches.

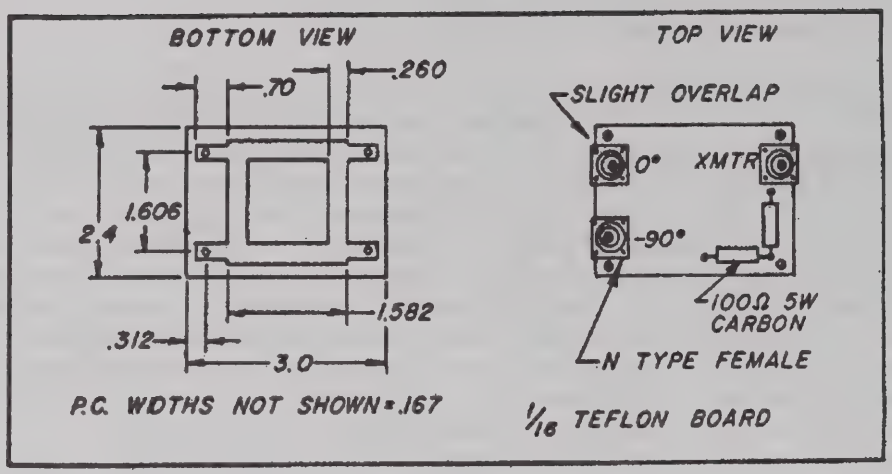


Figure 3. 1270 MHz quad hybrid. Dimensions are in inches.

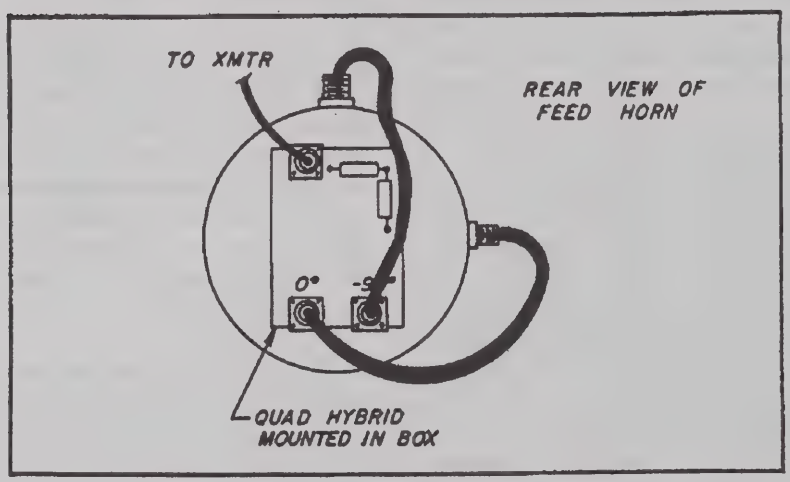


Figure 4. Wiring for right-hand circular polarization.

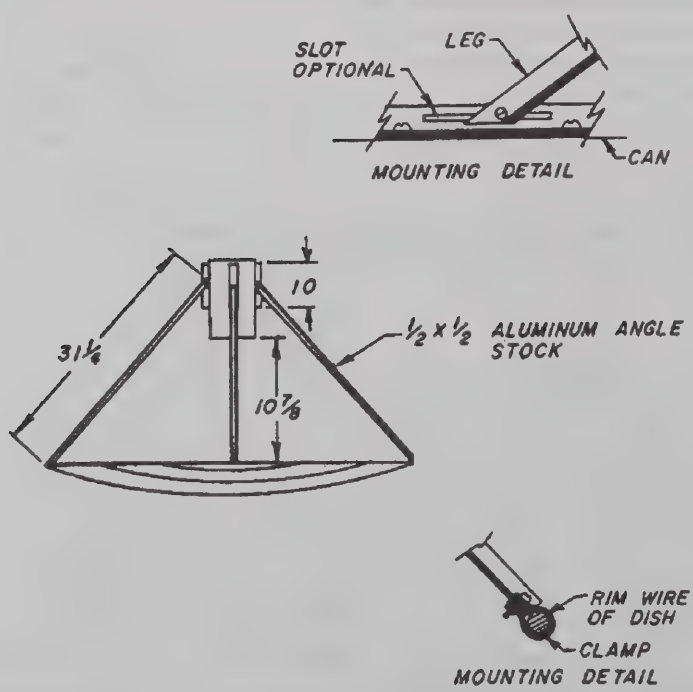


Figure 5. Tripod mounting leg dimensions. Dimensions are given in inches.

The dish surface is covered with 1/4 inch mesh galvanized hardware cloth. This is available at many hardware stores in different widths. A 6 ft. by 4 ft. piece will be plenty. Because of the parabolic shape of the reflector, it cannot be covered in one piece. Four pieces of the cloth are suitable if applied with about two inches of overlap to the four quadrants of the dish. The means for mounting the dish to the boom is shown in Figure 1. A flat aluminum plate is made from 1/8 inchstock and fastened to the wire frame of the dish by standoff clamps at four corners of the plate. At the center, two spacer blocks clamp between the dish and mounting plate. The standoff clamps can be bent from 1/16 inch aluminum or 1/32 inch steel strap. They are clamped around the wires of the dish and fastened to the boom plate with 6-32 hardware. The two halves of the dish should be first bolted together at the edges using the original loops in the dish wire for this purpose. Then the boom plate is fastened to the back of the dish using the clamps. Be careful that the clamps do not pull the dish out of its natural shape; bend new ones if this appears to be happening. Then start applying the hardware cloth to the dish surface. Put it on one quadrant at a time and fasten to the dish wires with plastic tie wraps. (Wire twists can be used too, but they are more time consuming.) Try to get a fastener every three inches or so along the dish wires. Overlap several inches when applying wire to the other quadrants. When finished with each quadrant, cut off the hardware cloth flush with the edge of the dish and carefully dress the wire ends down smooth. These ends can cut you severely if you are careless!! The completed dish will be quite rigid.

The feed horn proved to be the most difficult part of the project to design. It is basically a piece of circular waveguide operated above the TE11 mode cutoff and below the TM01 mode cutoff. It is excited by stub radiators approximately 1/4 wave long and 1/2 wave from the closed end of the guide. This description provides enough guidance to choose the horn diameter. A #10 food can of the sort that institutional quantities of fruit or vegetables come in is 6.1 inches in diameter and 6.85 inches long. This diameter gives a TE11 cutoff of 1135 MHz and a TM01 cutoff of 1484 MHz neatly positioning 1270 MHz in between. The length should be approximately one wavelength long. This length turned out to be extremely important in tuning the feed for 1270 MHz and determining bandwidth. The diameter and length of the feed studs are also important in

determining primarily the input impedance. Much time was spent optimizing these dimensions with an HP swept return-loss measurement system. The result for a single stub (linear polarization) is 20 dB return loss at 1270 MHz over a 20 MHz bandwidth in an 50 ohm system. This corresponds to a 1.2:1 VSWR. Dimensions of the horn and placement of the feed stubs are shown in Figure 2. Two full length #10 cans and a part of a third are soldered together. It is necessary to file or steel brush the rims very clean before soldering to get a good solder flow. The feed stubs are made from a two inch length of 1/8 inch hobby brass tubing soldered to the post of a type N connector. Cut a hole in the assembled feed can to clear the rear insulator diameter of the type N connector and scrape paint away from the edges of the hole for about 1 inch diameter. Then solder the connector shell (already assembled to the brass stub) directly outside of the can. This will take a very hot iron and some patience but you should end up with a solder bead uniformly around the edge forming a weather seal. Don't try to use other than a type N as the power levels to be used require a low loss, accurate 50 ohm connector. Be sure to measure carefully to place the second connector and probe exactly 90 degrees around the can and at the same distance from the open end as the first one. After this, the can should be coated with plastic spray to prevent rusting.

The last required detail is a method of splitting the 50 ohm transmitter power into two lines with a phase difference of 90 degrees to feed the two radiator stubs. This is ideally handled by a 3 dB quadrature hybrid. The fourth terminal of the hybrid is terminated in 50 ohms and absorbs any reflections from the antenna. (It could be alternately fed to a power meter to continuously indicate VSWR.) In this case, the hybrid and termination were designed to handle up to 100 watts forward power. To handle this power level the hybrid was designed on 1/16 Teflon double side board. It is a single square design shown in Figure 3. The shells of type N connectors are soldered directly on the top foil of the board with the post coming through and soldering to the hybrid pattern on the other side. The termination is made of two, 5 watt, 100 ohm carbon composition (NOT wirewound) resistors wired in parallel on the top of the board with extremely short ground leads soldered to the top foil. The other leads extend through the board and are soldered to the fourth hybrid arm again with leads as short as possible. The resistors are then liberally covered with RTV sealant and the board mounted as the cover of a 2½ inch by 3 inch by 1¾ inch Pomona box. Four screws secure the board at the corners and edges are covered with RTV for a weather seal. The Pomona box is secured to the rear of the horn feed with RTV. Two coax cables of equal length (16 inches is suitable) with type N connectors run to the two feed stubs in the can. Use RG213 or similar low loss cable. A little extra trouble and expense will pay worthwhile dividends in lower system loss. Follow the connection pattern in Figure 4 for right hand circular polarization. Reversing the feed cables would yield left hand circular.

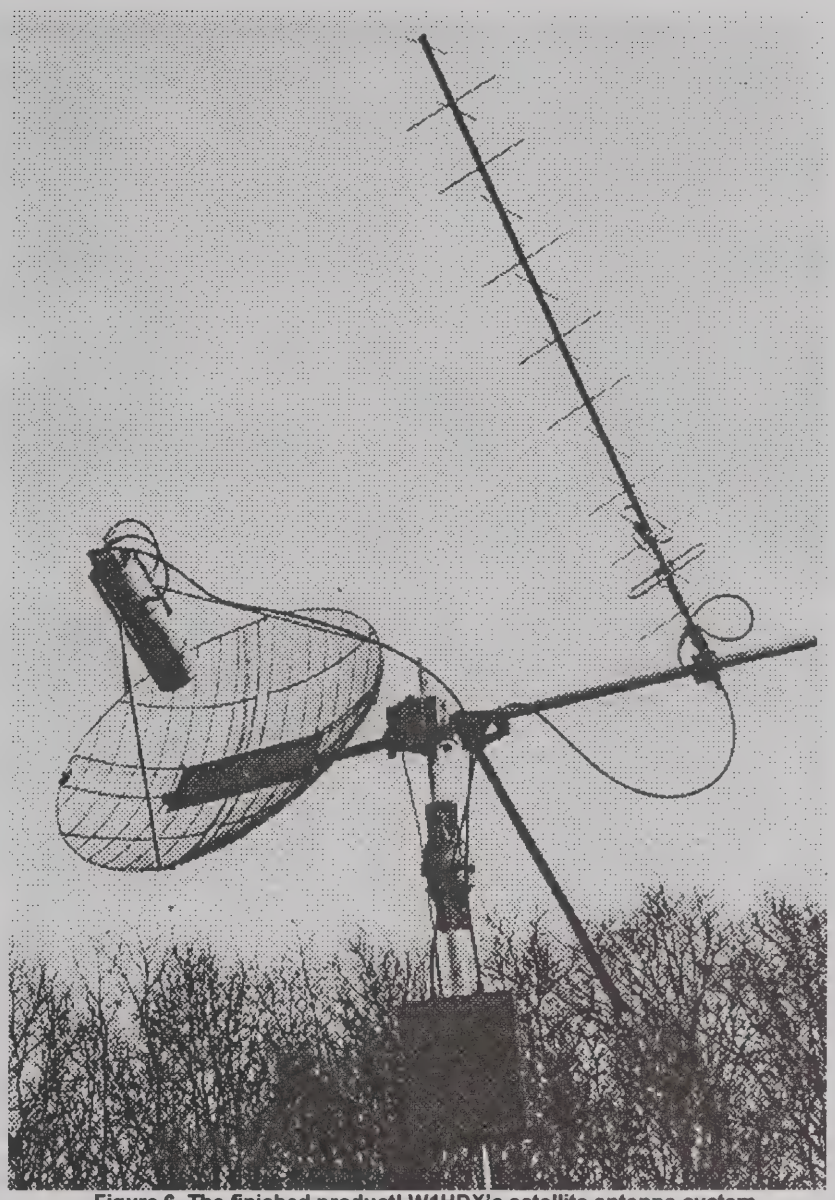


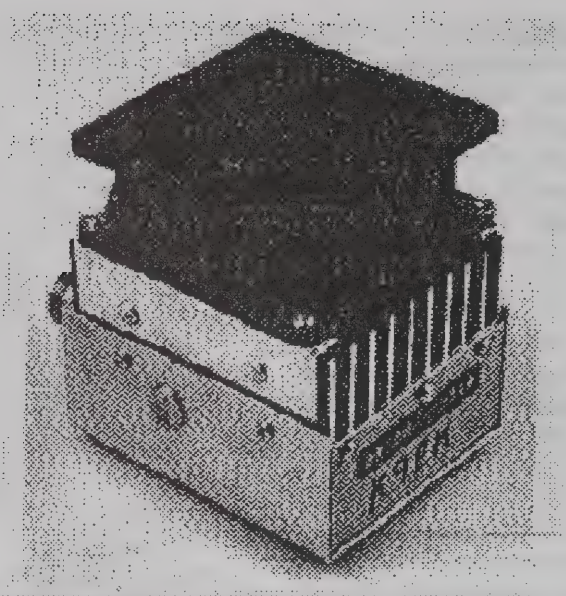
Figure 6. The finished product! W1HDX's satellite antenna system.

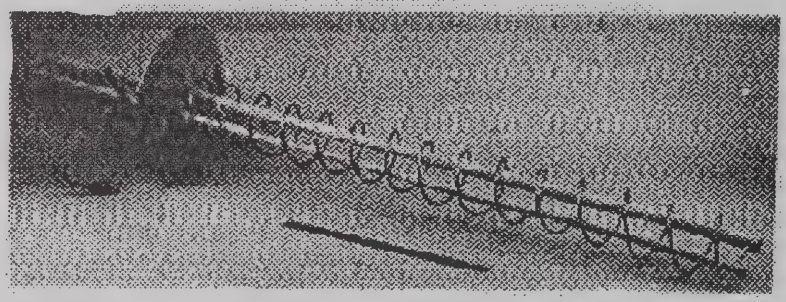
Figure 5 shows the mounting scheme and dimensions for attaching the feed horn assembly to the dish. The tripod legs are aluminum angle stock ½ by ½ inch. They are attached to the dish by U-clamps similar to those used on the boom mounting plate and secured by 4-40 hardware. At the horn, 10 inch pieces of angle stock are fastened at equal 120 degree spacing around the diameter and the tripod legs are fastened to them. The strips don't have to be 10 inches long but if you want a fine adjustment for focus you can mill a slot along these strips to receive the screw from the leg and move the feed horn easily in and out. A counterweight on the mounting boom will be essential.

The end result is shown as Figure 6 as mounted on a cross boom at the opposite end from a 70 cm crossed Yagi downlink antenna. The complete antenna measured though the hybrid shows a return loss of about 15 dB over a 50 MHz bandwidth. This is equivalent to a VSWR of 1.4:1 or a reflected power of about 6 percent. When fed with 100 watts forward power the reflected

6 watts results in noticeable heating of the 100 ohm resistors on the hybrid. In early tests some RG58 cable and BNC connectors were used. This caused very hot cable at 100 watts forward power and even at the 10 watt level should be avoided because these losses are so easily reduced by using the larger cable and connectors.

This antenna system fulfills all of the requirements for Mode L uplink use at high power levels. At a lower level of 10 watts input, the resulting EIRP of approximately 1 kW should be adequate for transponder communication and offers the advantage of a greatly simplified transmitter final output stage within the reach of solid state devices.■





The photos on the right are from "An Integrated L-Band Satellite Antenna and Amplifier" by Ed Krome K9EK in the 1998 ARRL Radio Amateur's Handbook. They show a modern antenna and amplifier designed for Phase 3D which will require much lower EIRP than AO10 (referred to by W1HDX in the accompanying article as Phase 3B) on Mode-L uplink, allowing simpler equipment and smaller antennas.

AMSAT Visits the Deep South

Fred Messina, WB5YKU

The cutting edge of Amateur Radio communications that will carry hams into the 21st century will meet some of the finest remnants of the 19th century in Vicksburg when members of AMSAT-NA gather in the Red Carpet City during October 16-18, 1998 for the 16th Space Symposium and AMSAT Annual Meeting.

The Headquarters for the four-day event is the Park Inn International with AMSAT-NA as the sponsor and the Vicksburg Amateur Radio Club (VARC) as the host.

Known during the War Between the States as the *Gibraltar of the Confederacy*, Vicksburg is a city of time contrasts where the epochal battles of the Civil War, known locally as the War of Northern Aggression, meet the most advanced sciences. The war is remembered in the more than 1,600 acres of the Vicksburg National Military Park where the visitor can, for a nominal fee, see where our great-grandfathers fought and died for the principles they believed in.

After a comfortable hour or so touring the modern Visitors Center (located 1/4 mile just north of the Park Inn) and viewing the audio-visual presentation of the Campaign for Vicksburg, the visitor can head out for a sixteen-mile self guided tour of the siege lines and fortifications where all the action took place in 1863. You can also opt for a tour guided by rented tape player and tape or a real, live guide who will ride with you explaining all that you will see on the rolling hills of the park. Near the end of the tour, you can see what the remains of the last iron-clad Union gunboat, the *Cairo*, and some of the artifacts that were raised with her from the waters of the Yazoo River in 1963.

After your park visit, drive into downtown Vicksburg and see the Old Court House Museum - Eva W. Davis Memorial with its fine collection of wartime artifacts as well as displays showing how the city lived from the pioneer days to the present.

On Washington Street, the visitor can drop into the Grey and Blue Museum for a glimpse of the naval aspects of the Vicksburg Campaign and then cross the street to see the Biedenharn Candy Co. Coca Cola Museum to see where and how the popular soft drink was bottled for the first time. In the same area there are a doll museum, a modern pharmacy coupled with a museum of firearms and medical artifacts and SHOPPING!!!

Although Vicksburg put up a fight, the wartime mayor remarked the city "did not know and was disinclined to learn the meaning of the word surrender." The city still has several antebellum homes that are open for tours. These range from the elegant mansion Cedar Grove, which is also a bed and breakfast inn and restaurant to McRaven where the visitor can see a home depicting three stages of Vicksburg's development beginning in pioneer days.

For those who want to add a little science and engineering to their visit, the U.S. Army Corps of Engineers Waterways Experiment Station (WES) is that organization's largest engineering and scientific research facility. WES's more than 1,200 employees work in fields such as hydraulics, soils, coastal and environmental engineering and computer technology. Some of the newest WES assets include a centrifuge that can produce 400G's on a one-ton payload and supercomputers that perform 600 billion calculations per second. Self guided tours are available every weekday except holidays and weekends. A Sunday morning tour of WES and Vicksburg National Military Park is planned for AMSAT Conference participants .

Man does not live by ham radio alone, so there must be some place to eat. Vicksburg is like New Orleans in this regard, if you can't find a meal, you aren't looking. The fine food ranges from old fashioned Southern at Walnut Hills to Lebanese at Eddie Monsour's at the clubhouse of the Vicksburg Country Club to typical American at Maxwell's and the Beechwood to continental at Jacques in the Park. There are also Rowdy's Family Restaurant, Goldies Trail Barbecue, The Cracker Barrel, New Orlean's Cafe, and the typical gamut of fast food establishments.

After AMSAT meetings all day and a good meal, it is time for a little evening entertainment. Four riverfront casinos offering a fantastic view of the Mississippi River feature table games, slot machines, food and drink and Las Vegas style entertainment.

Those planning to attend, and anyone who knows what Vicksburg can offer will know the attendance could easily double the 250 enthusiasts who attended the last year's meeting in Toronto, Canada, will be wanting more information on what there is to do and see in the city. All of that is just a phone call, or computer contact away.

The VARC contact is Eddie Pettis, N5JGK, and he can be reached at *n5jgk@amsat.org* or see the WWW page link at *http://www.amsat.org*. The Vicksburg Convention and Visitors Bureau can provide all the information a visitor needs, including a visitor's guide that lists all attractions, restaurants, motels, antebellum homes, bed and breakfast inns, and etc. along with a

Civil War history, antebellum homes, good weather, and entertainment makes Vicksburg a great place to meet.

Located on bluffs overlooking Interstate 20 and the Mississippi River, Vicksburg will host the 16th Space Symposium and AMSAT Annual Meeting during October 16-18, 1998.

detailed map to guide the visitor around the city. Contact the VCVB at 601-636-9421, domestic toll free at 800-221-3536 or e-mail at *http://www.vicksburg.org/cvb*.

The call for papers was made in March and the registration forms will be available in July plus details on accessing Park Inn-provided transportation to and from the Jackson International Airport.

Editor's Note: Fred Messina, WB5YKU is Senior Reporter for the Vicksburg Post and as VARC member has hosted many a Field Day at his cabin on shores of Eagle Lake, a Mississippi River oxbow lake. Fred will be coordinating local press activities during the upcoming AMSAT conference. Also, AMSAT group tours of the Waterways Experiment Station and Vicksburg National Military Park are planned for Sunday morning. Y'all come! ■

AMSAT Journal Telemetry

AMSAT Board of Directors Nominations

It is time to submit nominations for AMSAT-NA Board of Directors. AMSAT member societies or five individual members may make nominations of fellow members to serve a two year term. Three seats on a seven member board must be filled this year. The board members whose terms are expiring are Keith Baker, KB1SF, Tom Clark, W3IWI, and Andy MacAllister, W5ACM. Please be sure that anyone you nominate understands that meeting attendance is necessary. There are generally two Board of Directors meetings per year (Spring and Fall). Nominations should be marked ***Board of Director Nomination*** and sent to: *AMSAT, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703* and **must arrive by June 15, 1998**.

13th AMSAT-UK Colloquium - Call for Papers

The 13th AMSAT-UK Colloquium will be held at Surrey University, Guildford, Surrey, United Kingdom from Friday, July 31 to Sunday August 2, 1998. This year's event will include technical and operational matters as well as an IARU forum.

AMSAT-UK invites authors to submit papers, about Amateur Radio space and associated activities, for this event and for the proceedings document which will be published at the same time. We normally prefer authors to present the papers themselves rather than having someone else read them in the authors' absence, but we also welcome *unpresented* papers for the document. Offers of Papers should be submitted as soon as possible; the final date for full documents is mid-June 1998 in order that the proceedings document be available to participants. Submissions should be sent ***only*** to Richard Limebear, G3RWL, via the following routes:

- Internet e-mail: *g3rwl@amsat.org*
- Packet Radio: G3RWL @ GB7HSN.#32.GBR.EU
- Satellite: AO16/19/22/23/25
- Terrestrial mail: R.W. L. Limebear, G3RWL, 60 Willow Road, Enfield EN1 3NQ, United Kingdom. (I have no fax)

AMSAT-UK also invites anyone with requests for Program Topics to submit them as soon as possible to G3RWL. Topics already *in* are:

- Who Are the Little LEOs and Why Do They Want My Bands ? - W3DQ
- Debate: What do we do with Phase 3D? - HB9AQZ
- Future Software SATCOM - W1VF
- Mobile LEO terminals - (speaker wanted)

Ron Broadbent, G3AAJ Honored by RSGB

Ron Broadbent, G3AAJ, was honored by the Radio Society of Great Britain (RSGB) on February 22, 1998, when he was presented with their Louis Varney Cup; Louis' callsign, G5RV, may be familiar to some. The cup is in the gift of the RSGB's VHF Committee and it is presented annually for *advances in space communication*. Ron's 20 years of service as Secretary of AMSAT-UK, before his retirement last December, make him well fitted for this honor. Many advances could not have happened without his tireless work for the good of amateur satellites and the amateur radio fraternity worldwide.

QST, QST Calling All Satellite Operators

Have you ever wondered what other satellite amateur radio operators and their stations look like? Wayne Grove, K9SQL has prepared a WWW photo album of amateur radio satellite operators available via *http://www.parlorcity.com/k9slq*. Wayne invites anyone to e-mail a .gif or .jpg photo of you and/or your shack to *k9slq@parlorcity.com*. If you do not have means to capture a computer graphic file you can send a photo to Wayne who will scan and return it. Do not to forget to include your name, callsign and email address. Send photos to: Wayne Grove, K9SLQ, 1025 W. Lancaster St., Bluffton, IN 46714

BID Naming Format Changed

In order to prepare for the year 2000 and to accommodate some file storage problems in the packet radio BBS world, Ray Hoad, WA5QGD made a change to the BID naming format of the AMSAT and NASA 2-line Keplerian messages.

Ray's first change using a full four digit year was not successful and he learned a lot about the limits of packet radio BBS software. After receiving many useful comments, Ray believes he has a suitable format for BID. (This is the best that can be done with the various restrictions resulting from the packet BBS software used in the United States and in Europe.)

The new BID structure is ***orbyyjjj.x*** where ***yy*** is the last two digits of the year, ***jjj*** is the day of year, and ***x*** is ***O*** for OSCAR, ***D*** for digital, ***W*** for weather, ***M*** for miscellaneous, or ***N*** for NASA 2-line.

If you are searching for the distribution message titles, please note that the two title names for the distribution messages will now be *orb98jjj.amsat* for the AMSAT format and *orb98jjj.2l.amsat* for the NASA 2-line format.

These changes may not be what you personally would like to see, but it is the best available fit for the majority of the users. In the past there have been very few changes to the Keplerian distribution process or the structure of the elements themselves. The

Ian Kyle, M0AYZ (r) presenting former AMSAT-UK Secretary Ron Broadbent, G3AAJ the RSGB G5VR Trophy *for services to amateur satellites.* (Photo provided by Fred Southwell, G6ZRU)

above changes are necessary and are best made now before things get busy in last months of 1999. Thank you for your patience and the help in this matter.

RS-16 News

The following was received via packet radio from Pat Gowen, G3IOR:

The good news to report to you is that John Heath, G7HIA just heard from Leo Labutin, UA3CR that the bumper bundle of command station gear funded by the Sputnik Special Event Station arrived safely in Moscow. (Editor's note: See page 16 of March/April issue of The AMSAT Journal.) The bad news is that so far all attempts to put the RS-16 transponder on have failed. They will continue to try, but without much hope. Similarly RS-10 is failing to respond to commands. With OSCAR-10 now possibly in terminal decay, that doesn't leave much by way of Mode-A satellites. Just RS-12 to carry the load it seems. RS-16 will only be in orbit for another year anyway. (via Ray Soifer, W2RS)

Jenny (G1LIT) and Fred (G6ZRU) Southwell representing AMSAT-UK at the Sandown Park RSGB Rally, United Kingdom. Fred and Jenny also edit the *OSCAR News*. (Photo via Ray Soifer, W2RS)

Amateur Satellite Internet Link

Bob Bruninga, WB4APR, reports that he is in the process of building a network of linked ground stations to provide almost continuous coverage for some of the current digital amateur satellites. WB4APR's idea is that these linked stations would use only simple antennas and operate unattended 24-hours a day, as many Amateur Radio digital stations currently do. They would be linked to the Internet so that any packets heard by any linked station would be merged together into a single Internet stream of raw packets for all stations. This would allow amateurs to manage their digital satellite transmissions by seeing data flow even when a selected satellite is out of range of their own station. It would also let hams on one continent see how the same satellite is being used over a distant area.

Bob reports that the Internet side of this idea has been completed by Steve, K4HG, and is working fine, having been on line for more than a year. According to WB4APR, Steve's site has demonstrated being able to handle over two dozen simultaneous 1200 baud packet feeds and at least 150 simultaneous users. This example system is the worldwide APRS server. Steve is now building another system just for digital amateur satellites.

Bob reports the system now needs more stations with dedicated 24-hour Internet access for each local footprint and satellite. Station requirements include digital satellite gear, computer equipment, and telnet access or TCP/IP Internet service. Bob reports stations do not need to see all packets horizon to horizon. "What really counts is that at least one station in the link out of the sum of all stations hears the packet at least once," Bob said. Everyone then gets the data via the

Internet link. The central server will remove all duplicate data.

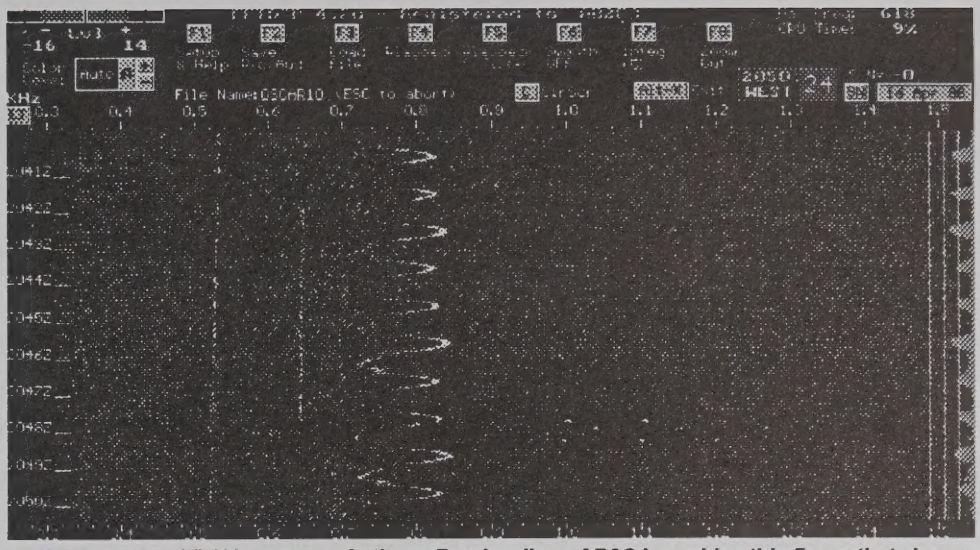
WB4APR says that a few amateurs have already responded to his request and are looking into setting up stations in the United States, Mexico, Taiwan, and Spain. Interested stations should contact WB4APR at his e-mail address: *bruninga@nadn.navy.mil* (*via AMSAT News Service*)

Phase 3D Callsign to Fly Award Still Available

Ron Broadbent, G3AAJ, AMSAT-International board member, told AMSAT News Service recently the *Callsign to Fly Award* for Phase 3D is still open for more donations from around the world in any currency. Ron informed us that he had a complete breakdown of his e-mail system between March 11 and April 11, 1998. As a result he has not been able to reply to enquiries and other messages about the AMSAT-UK *Your Callsign Can Fly Award.* Ron says that they already have 145 callsigns on the first engraved plate (see the November/December issue of *The AMSAT Journal*) and a second plate is now awaiting engraving. Those individuals that contribute a minimum of $288.00 (US) will receive a personal engraved plaque and have their name and callsign engraved on a plate fixed to the spacecraft. A photograph will also be sent to each contributor. Information on the *Callsign to Fly Award* can be obtained via e-mail: *g3aaj@amsat.org* or writing to: Ron Broadbent, G3AAJ, *AMSAT-UK Callsign to Fly Fund*, 40 Downs View Small Dole, Henfield, West Sussex, BN5 9YB, United Kingdom. Details of the program are also available on two active amateur digital satellites, KO-23 and KO-25. AMSAT-NA members can also contact AMSAT-NA headquarters during normal business hours. (*via AMSAT News Service*)

TechSat-1b Launch Planned

On April 28, 1998, Assi Friedman, 4X1KX/KK7KX informed AMSAT-BB readers that the Israeli Techsat Team confirmed that the tentative launch date for the TechSat-1b from Russia is scheduled for June 23 or 24, 1998. TechSat-1b will be very similar to TechSat-1a, an earlier Israeli satellite that was lost in a launch failure in 1995. TechSat-1b will use 9600 baud FSK (similar to UO-22, KO-23, and KO-25) and have VHF/L-band uplinks and UHF downlinks. Roni Waller, Technion Satellite Software Manager at the Asher Space Research Institute informed Friedman that he will soon provide additional information on TechSat-1b including frequencies, BBS callsign, launch parameters/orbit, a telemetry decode program and GSONLINE/Amateur version software. AMSAT members are asked to monitor AMSAT News Service bulletins for future updates on the launch and use of TechSat-1b.



Using AF9Y's FFT42 program, Anthony Bombardiere, AB2CJ provides this figure that shows AO-10 in a dormant condition. The trace near 800 Hz shows AO-10's carrier signal. Obviously the signal is not a steady carrier which is typical when AO-10 is in its dormant period. AO-10 was approximately 21,000 km from AB2CJ's station. Anthony used a 20 element cross Yagi.

Errata

A photo appearing on page 4 of the November/December issue of *The AMSAT Journal* mistakenly identified one of the AMSAT Banquet participants as Paul Willmott, VP6MU of AMSAT Bermuda. Paul humorously informed us that the person in the photo is not him. This only leaves the mystery of who is the person in the photo?

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